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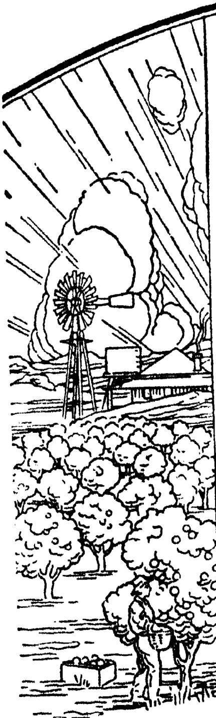
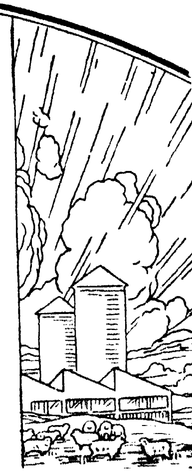
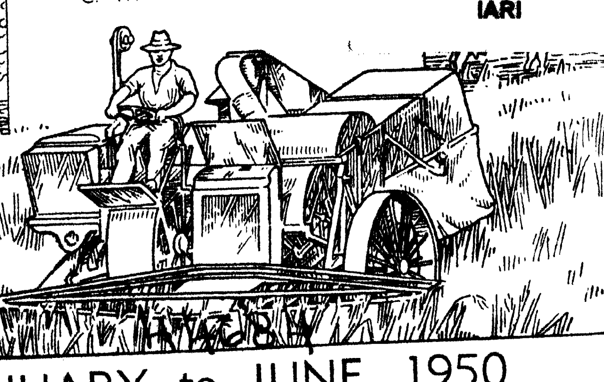




ISSUED BY DIRECTION OF

THE HONOURABLE THE SECRETARY FOR AGRICULTURE AND STOCK

Edited by
C. W. WINDERS, B.Sc.Agr.



JANUARY to JUNE, 1950

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Issued by Direction of
THE HONOURABLE H. H. COLLINS
MINISTER FOR AGRICULTURE AND STOCK

GOVERNMENT PRINTER, BRISBANE

Contents

THE MINISTER'S NEW YEAR MESSAGE.

» «

Looking back on agriculture in Queensland during the 1940's, primary producers might well feel proud of their achievements in a period filled with difficulties. The magnificent way in which they responded to the Nation's call for food during the war years, and their enterprise in producing crops to which they were unaccustomed, will long be remembered. The setting of records in some fields of production within recent years, despite many handicaps, similarly merits commendation.

Hon. H. H. Collins.

The year 1949 has seen a strengthening of the price structure for important agricultural and pastoral commodities produced in Queensland. Producers' organisations and Governments alike have been striving to secure or maintain a good measure of stability in the marketing of primary products. Long-term contracts, reviewable at intervals, and participation in international planning for the disposal of farm products, have contributed to this end, and the coming decade promises to be one of prosperity for Queensland producers.

This note of confidence, however, must be tempered by the realisation that selling at a profit implies efficiency in production. It is with this aspect of primary production that the technical services of the Department of Agriculture and Stock are particularly concerned. It is well recognised that there is usually a lag in the application of the findings of agricultural research to farm practice, but I feel sure that the circumstances of farming during the next decade will ensure a receptive field for the application of technological advances. The Department certainly will continue, with the very welcome co-operation of producers, to play an active part in the solution of farm problems and the dissemination of information.

On the eve of the new decade, I join with the members of the Department's staff in extending good wishes to all engaged in the land industries.

Minister for Agriculture and Stock.

Expanding Services to the Man on the Land.

ARTHUR F. BELL, Under Secretary.

War Activities and Re-organisation.

IN common with most organisations, the development and many of the basic activities of the Department of Agriculture and Stock were suspended during the war. One-third of the staff were absent on duty with the armed forces, or technical services directly associated with the war effort.

Those who remained were called upon to perform many duties far outside the normal range. The Department provided advisory personnel to assist numerous national committees and other organisations; it provided the State Executive of the National War Agricultural Organisation, while field staff acted as the executive officers of the forty District War Agricultural Committees; it undertook the rationing of fertilizer and stock foods and assisted in the allocation of the short supplies of farm machinery and materials; it co-operated with the Manpower Directorate in the provision of rural labour, the release of army personnel for rural work, and the placement on farms of Women's Land Army girls and prisoners of war; it fostered special new crop and food production drives; and it provided special technical services to the armed forces.

The magnitude of the extra duties during the years 1942-46 may be gauged from a statistical summary of some of these activities:—

More than 180,000 applications for the release of materials were received and considered, and recommendations made to the appropriate Commonwealth releasing authorities.

Sixteen thousand applications for the release of personnel from the Services for rural work were examined for recommendation to Manpower; this almost invariably required an inspection of the property in question and its activities.

Ten thousand applications for fertilizer rations received individual attention each year.

Two hundred and fifty thousand permits to buy stock food were issued to 130,000 applicants.

Twenty-five thousand applications were received for the release of tractors, engines, and other farm machinery, evaluated, and nearly 12,000 releases made.

Equipment of permanent and seasonal camps, allocation to farms, and the organisation of transport was carried out on behalf of the Australian Women's Land Army.

One thousand one hundred and ninety-seven prisoners of war were placed on farms or pastoral holdings.

Innumerable representations were made in respect of improved petrol rations, priority for goods, and many other matters affecting primary production.

In 1943 the Deputy Public Service Commissioner and the writer (then acting as Director of Sugar Experiment Stations) were directed to enquire into the organisation, staffing, and services of the Department of Agriculture and Stock, with a view to determining in advance the adjustments necessary to meet post-war needs. On the basis of the report submitted the Department was completely re-organised.

The re-organisation took cognizance of the growing complexity of the services demanded of a modern Department of Agriculture, probable avenues of development in primary production, and deficiencies in the services then being rendered. For administrative purposes the Department was divided into five Divisions, namely—Plant Industry, Animal Industry, Dairying, Marketing, and General Administration. Each Division in turn is composed of constituent branches of which there are now twenty-two.

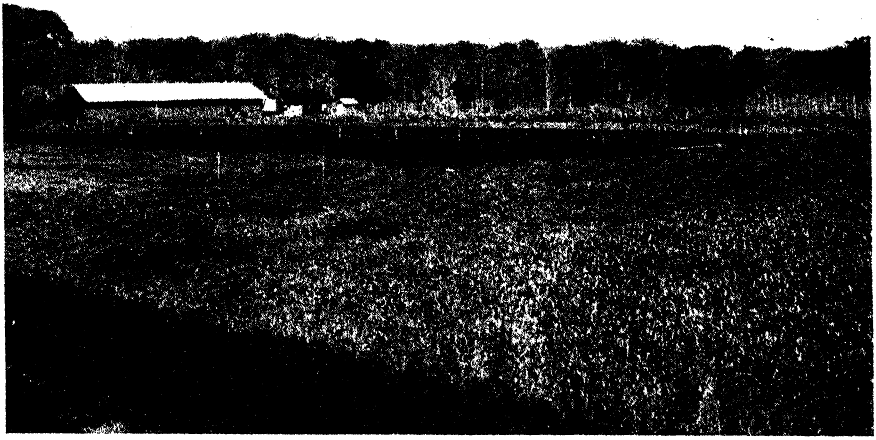


Plate 1.

REDLANDS HORTICULTURAL EXPERIMENT STATION.—This new station, of 26 acres, provides facilities for experimental work on fruit and vegetable crops.

Recent Developments.

The purport of this short article is to give an outline of the development of *new* services to the primary producer since the re-organisation in 1945. It could not, within reasonable limits, attempt to cover the full range of Departmental activities (in this connection it might be noted that the Annual Report for 1948-1949 occupied 100 pages of foolscap size). Omission of mention of particular services should therefore be interpreted as indicating no substantial change in form and scope of activities since 1945.

Broadly speaking, the functions of a Department of Agriculture are twofold. On the one hand it should carry out continuous research and investigation into problems which adversely affect primary production and the processing and marketing of primary produce or, alternatively, into avenues of new or increased production. At the same time it must take to the farmer the information so gained, in order that it may be translated into practice. To carry out these requirements the Department employs officers trained in more than twenty professions, and has field officers stationed in more than eighty centres with a State-wide distribution.

The extension of these services since 1945 is outlined below:—

Experiment Stations.

There has been a marked advance in the provisions of experiment station facilities, particularly in tropical North Queensland. From Mackay north there are long-established Sugar Experiment Stations at Gordonvale and Mackay, a Tropical Agricultural Station at South Johnstone, and an Animal Health Station at Townsville Within the

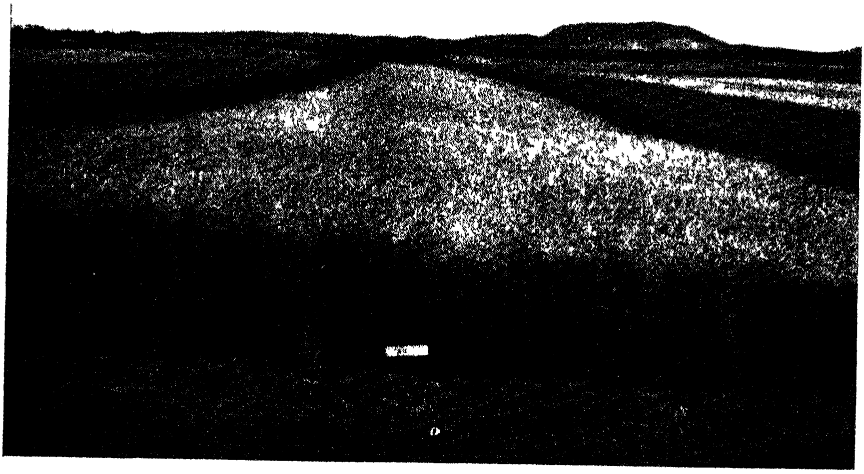


Plate 2

HERMITAGE REGIONAL EXPERIMENT STATION.—Situated near Warwick, this station is engaged in investigations of crop and livestock production problems of the eastern Darling Downs This view is of a wheat variety trial

last few years there have been established Regional Experiment Stations at Kairi, near Atherton, and at Ayr, a Tobacco Experiment Station at Mareeba, with sub-stations on the Herbert and Burdekin Rivers (the latter serving as a demonstration area for soldier settlement); another Sugar Experiment Station in the irrigated area of the Burdekin, and two cane breeding sub-stations at Babinda and Mackay; a Horticultural sub-station at Cairns; and a Pasture sub-station at Utchee Creek, which will serve as an adjunct to the South Johnstone Station. In addition a Beef Cattle Research Station will be established conjointly by the Australian Meat Board, the Commonwealth Scientific and Industrial Research Organization, and the Department of Agriculture and Stock.

In Southern Queensland the cotton station at Biloela has been incorporated in a Regional Experiment Station, and a Regional Station has been established near Warwick; a Horticultural Experiment Station has been established at Nambour, and a Vegetable Station at Ormiston in the Redlands district; this Department is responsible for the technical

Plate 3.

BILOELA REGIONAL EXPERIMENT STATION.—This station has taken over the activities of the Cotton Research Station, and now devotes attention to crop and livestock production in the central agricultural areas. Linseed, shown in this picture, is one of the newer crops under trial.

Plate 4.

BURDEKIN TOBACCO SUB-STATION.—The security of ex-servicemen settlers in the Clare district is assisted by this Departmental tobacco station. The view is of tobacco seed-beds, with a curing barn in the background.

operations of the Irrigation Research Station provided by the Bureau of Investigation of Land and Water Resources at Gatton; the Sugar Experiment Station at Bundaberg, and the Animal Health Station at Yeerongpilly are expanding their long-standing services; a second jointly-operated Beef Cattle Research Station will also be developed in Southern Queensland in the near future.

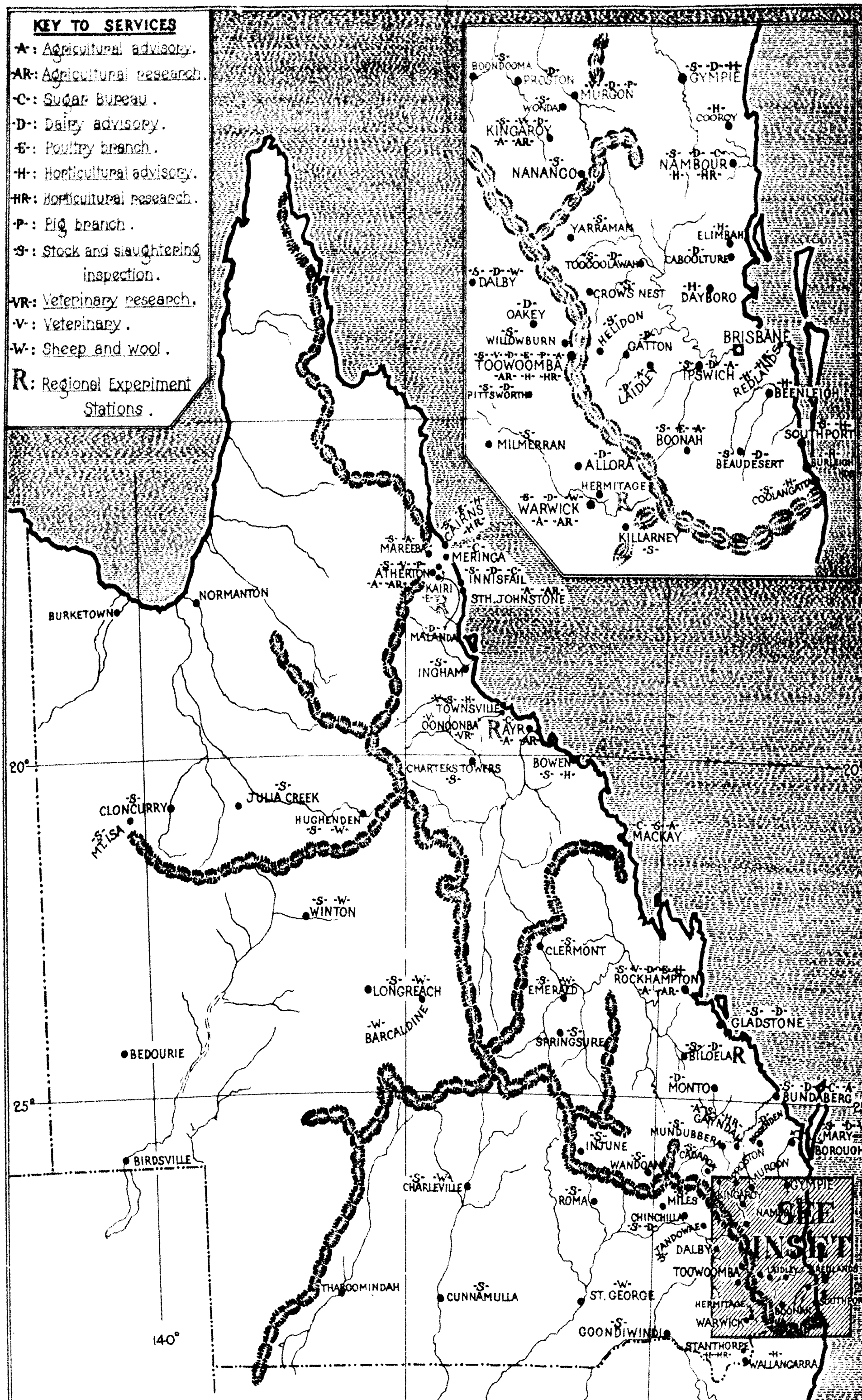
Plate 5.

INTRODUCING NEW METHODS IN SHEEP HUSBANDRY.—Graziers are shown here practising the Mules operation at a Field Day organised by the Department. This operation provides a high measure of protection against breech strike by the blowfly.

The Department is under more or less constant pressure to open new local experiment stations. However, while a certain coverage of experiment stations is necessary for investigational work, resources should not be dissipated in maintaining an excessive number. As stated in the Annual Report for 1948-1949, experiments actually carried out on the farms are the basis of progress and, while some experiment stations are a necessary adjunct to this work, they are not a substitute for it.

Sheep and Wool.

The sheep and wool industry now occupies first place in monetary earnings. From a very small section in the Department, with only one field officer stationed outside Brisbane, there has been developed an active Branch with officers stationed in eleven pastoral centres, with more staff in training. This greatly increased service has enabled the value of improved practices to be brought home to increasing numbers of sheep men. During the year 1948-1949 this staff visited 1,249


KEY TO SERVICES
-A-: Agricultural advisory.
-AR-: Agricultural research.
-C-: Sugar Bureau.
-D-: Dairy advisory.
-E-: Poultry branch.
-H-: Horticultural advisory.
-HR-: Horticultural research.
-P-: Pig branch.
-S-: Stock and slaughtering inspection.
-VR-: Veterinary research.
-V-: Veterinary.
-W-: Sheep and wool.
R: Regional Experiment Stations.
GYMPIE
KINGAROY
NANANGO
NAMBOUR
MURGON
WONDAI
PROSTON
BOONDOOMA
COOROY
YARRAMAN
ELIMBAH
CABOOLTURE
TOOGOOLAWAH
DALBY
CROWS NEST
DAYBORO
OAKEY
HELIDON
WILLOWBURN
GATTON
BRISBANE
TOOWOOMBA
PITTSWORTH
LAIDLEY
IPSWICH
REDLANDS
BEENLEIGH
MILMERRAN
BOONAH
SOUTHPORT
BURLEIGH
ALLORA
BEAUDESERT
HERMITAGE
COOLANGATTA
WARWICK
KILLARNEY
CAIRNS
MAREEBA
MERINGA
ATHERTON
INNISFAIL
KAIRI
STH. JOHNSTONE
NORMANTON
BURKETOWN
MALANDA
INGHAM
TOWNSVILLE
OONOONBA
AYR
BOWEN
CHARTERS TOWERS
CLONCURRY
JULIA CREEK
HUGHENDEN
MT. ISA
MACKAY
WINTON
CLERMONT
EMERALD
ROCKHAMPTON
LONGREACH
BARCALDINE
GLADSTONE
SPRINGSURE
BILOELA
BEDOURIE
MONTO
BUNDABERG
GAYNDAH
MUNDUBBERA
INJUNE
MARYBOROUGH
BIRDSVILLE
WANDOAN
CHARLEVILLE
ROMA
MILES
CHINCHILLA
JANDOWAE
SEE INSET
THARGOMINDAH
CUNNAMULLA
ST. GEORGE
GOONDIWINDI
STANTHORPE
WALLANGARRA
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properties in an advisory capacity, held 21 field days, and carried out 718 demonstrations; drought feeding of stock by approved methods was supervised on 120 properties.

A scheme for subsidising the purchase of long-wool rams, so as to improve the quality and quantity of lamb meat, was introduced in 1948, and the purchase of some 400 rams was subsidised in the year. Two officers were sent to New South Wales to study the latest developments in fat-lamb raising.

Equipment has been imported, and during the current year it is anticipated that a fleece-testing unit will be put into operation; this will enable breeders to secure the information on fleece characteristics which is essential for progeny testing in sheep breeding.

As a result of energetic advocacy and demonstration of the Mules operation as a measure for blowfly control, this method has been introduced into a large proportion of breeding flocks. Vaccine for the control of scabby mouth, brought out initially by the Animal Health Station at Yeerongpilly is being increasingly used and 522,500 doses were distributed in 1948-1949.

Sugar Experiment Stations.

The Bureau of Sugar Experiment Stations was brought to a high state of development in the early nineteen thirties; the yield of sugar per acre was 40 per cent. higher in 1939 than in 1929, and the total crop 70 per cent. higher. In view of the pronounced success which attended cane breeding operations at Cairns, Mackay, and Bundaberg, these activities have now been extended by the establishment of a new experiment station at Ayr, and two cane breeding sub-stations at Babinda and Mackay. Two Bureau canes, Q.28 and Q.50, which were bred at the Mackay experiment station within the last few years, now constitute some two-thirds of the crop in the central district. More than 25 per cent. of the State's 1948 crop was comprised of canes bred by the Bureau in recent years.

A New Pineapple Section.

In view of the importance, and potentially greater importance, of the pineapple industry a special pineapple section has recently been set up within the Horticulture Branch. An officer with experience in both research and field advisory work has been placed in charge of this team and it will be his responsibility to translate the findings of research workers into the practical advice of the field officer. With headquarters at Nambour, pineapple research and field specialists will be stationed at Townsville, Ayr, Gympie, Nambour, and Caboolture, and also in the research laboratories in Brisbane.

Dairying.

Butter production in Queensland steadily declined from the record of 69,000 tons in 1938-39 to the low figure of 33,000 tons in the drought year of 1946-47, but had increased to 47,000 tons in 1948-49. Special efforts are now being made to restore production by increased efficiency and in this work the Department is being aided by a financial grant from the Commonwealth Government.

The staff of the Dairying Division has been doubled in the past four years. In order to further improve the research and investigational services two young men were sent to New Zealand in 1948 and it is expected that a third will go in 1950. On their return these

officers will specialise in butter manufacture, cheese manufacture, and whole milk production respectively.

A system of group herd recording has been developed and rapidly extended. A group consists of about 22 herds each of which is tested once per month; the promulgation of the results of the tests among the farmers of each group is assisting culling, is stimulating interest in better husbandry, is of great general educational value, and is engendering a healthy spirit of competition. Thirty-one such units, each under the control of a special officer, are now working and more are in course of organisation.

Plate 6.

BREEDING BETTER SUGAR CANE.—This is a crop of the variety Q.50, bred by the Bureau of Sugar Experiment Stations and now widely grown in central and southern cane districts.

The number of producers supplying milk to Brisbane increased from 700 in 1943 to 1,400 in 1948; whereas in 1938 some 4,000 gallons of bottled pasteurised milk were sold in Brisbane daily, the daily average in 1948 was 24,000 gallons, while a further 10,000 gallons of pasteurised milk is sold unbottled. The proportion of bottled pasteurised milk sold in Brisbane is higher than in any other State capital. The necessary inspections and examination of milk have increased correspondingly and in the year 1948-49 a total of 121,505 samples of milk was examined in the Dairy Research Laboratory, compared with 56,108 in 1943-44. The quality of milk has rapidly improved and in 1948-49 the number of samples of unsatisfactory quality was little more than half that in 1943-44.

Pasteurisation of milk is being fostered and pasteurisation plants now operate in Brisbane, Southport, Merrimac, Ipswich, Toowoomba, Warwick, Nambour, Murgon, Rockhampton, Mackay, Innisfail, Cairns and Malanda.

Pure bred herd recording, which naturally was virtually at a standstill during the war, has increased rapidly and 154 herds were tested in 1948-49. Any further extension of this rather exacting work is limited by the pressure of other duties on dairy officers.

The Division of Dairying, the Agriculture Branch and the Cattle Husbandry Branch have co-operated in an intensive drive to promote dairy efficiency.

Six organised group feeding trials are being carried out on 24 farms in major dairying districts, while two more groups will be launched shortly. These groups each consist of four farms and carefully determined rations are being fed to cows on three of these, while the fourth remains on the old feeding basis; the methods of feeding will be rotated each year to give a further check on the relative value of the different feeding methods.

Forty-two farms have been selected as "demonstration farms" and selection of another twelve will be completed shortly. The owners of these farms have agreed to carry out recommended practices in respect of pasture improvement, fodder conservation, subdivision of paddocks, care of the herd, &c. The results obtained will demonstrate the benefits and increased yields which may be expected.

Fifty-five pasture improvement trials, distributed through the main dairying districts, are now in progress. Over the past two years 215 varieties of newly imported pasture plants (grasses and legumes) have been planted on the Regional Experiment Stations, where their performance under Queensland conditions is being investigated.

A scheme for the systematic tuberculin testing of dairy herds supplying the metropolis was initiated in 1945 and during the year 1948-49 over 71,000 animals from 1,243 herds were tested. Although a heavy incidence of the disease was found in certain districts the number of affected animals found in the second round of tests has been very small. T.B. testing is also being carried out on the Darling Downs and in areas supplying Ipswich, and South Coast towns, and will be extended to other areas as circumstances permit.

An associated scheme for the encouragement of resident fully qualified veterinary practitioners in dairying districts was put into operation some 18 months ago. Approved practitioners are given "block testing" within a defined district with the proviso that the practitioner may be required to live within a stipulated area. The granting of testing rights ensures the initial steady income necessary to attract the practitioner; nine veterinarians are now testing under this scheme.

Veterinary Services.

A scheme for the encouragement of private practitioners is outlined in the preceding paragraph; this will relieve Departmental veterinary officers of routine testing and increase their concentration on disease prevention and advisory services.

Realising the need for expanded veterinary services the Department in 1945 commenced the award of veterinary scholarships at the University and there are now twenty scholarship holders in various stages of their course. Since they have entered into bonds to serve the Department upon graduation, a very material increase in veterinary staff is imminent. In addition the Premier has recently announced that the University will be given the financial assistance necessary to reopen the Faculty of Veterinary Science on a fully operative basis, thus ensuring a steady flow of veterinarians to the animal industries of the State.

Decentralisation of Pig and Poultry Advisory Services.

In the past the instructional staffs of the Pig and Poultry Branches were all stationed in Brisbane. whence they made periodical visits to country centres. However, the building up of the advisory services which has taken place since the reorganisation has enabled the stationing of officers in country centres where they can maintain better contact with the producers.

Advisory officers of the Pig Branch are now to be found in Brisbane, Toowoomba, Murgon, and Atherton, one will take up duty at Biloela shortly, while young officers in training will soon be available for other centres. During the past year these advisers paid visits to nearly 1,700 farms.

The poultry industry is to a considerable degree concentrated in or near the Greater Brisbane area and there is thus necessarily some concentration of advisory officers at Headquarters; in addition, advisers are now stationed at Toowoomba, Rockhampton, Atherton, and Townsville, while another officer has been attached to the Regional Experiment Station at Kairi in order to carry out poultry feeding experiments under North Queensland conditions.

Cattle Husbandry.

Branches providing advisory services aiming at improved methods of sheep, pig and poultry husbandry have been established for many years and, as stated above, these services have recently been markedly expanded. However, for various reasons, no similar service was provided for raisers of beef and dairy cattle.

In 1948 steps were taken to correct this position by setting up a Cattle Husbandry Branch; the technical staff of this Branch now numbers five, while several holders of Departmental scholarships will take up duties on completion of their University studies.

Up to the present the Branch has concentrated upon investigating and advocating improved methods of dairy cattle husbandry in association with the drive for greater efficiency in the dairy industry. Meanwhile steps are being taken to recruit staff for the study of beef cattle husbandry problems and the first appointee is now obtaining practical cattle management experience on a northern station property.

Improved standards of cattle husbandry are closely associated with improved levels of nutrition; pasture experiments are a most important phase of the necessary investigations and are outlined in the section dealing with dairying.

Soil Conservation.

Immediately prior to the war officers of the Agriculture Branch established a number of soil conservation experiments on the Darling Downs and in the Kingaroy district. The first step towards the establishment of a soil conservation service was taken by the appointment of a Soil Conservationist in September, 1947. In the intervening two years it has been possible to increase the technical staff to nine and field officers are now located on the Darling Downs, at Kingaroy, and at Atherton.

Steps have been taken to establish soil-conservation demonstration areas in districts menaced by erosion and to date twenty such demonstrations have been completed and stand as a permanent reminder that this menace can be overcome.

The factors influencing soil erosion in Queensland are very different from those ruling in those countries where most of the research on soil conservation has been carried out. Consequently the Departmental soil conservation service must devote a great deal of its resources to investigation and develop methods suitable to Queensland conditions as it proceeds. In this respect the Regional Experiment Stations have proved indispensible; experience gained on the Kairi (Atherton) Station, for example, where a trial contour banked area withstood the onslaught of 21½ inches of rain in eight days, will be of great value as a basis for recommendations on the Atherton Tableland.

Plate 7.

BEATING SOIL EROSION.—This is a view of a Field Day gathering of farmers getting first-hand information on soil conservation practices on a Soil Conservation Demonstration Farm.

Interest in conservation practices is growing rapidly and the staff cannot as yet cope with the requests for assistance. Naturally, persons trained and experienced in conservation technique are not readily available and steps have been taken to train enthusiastic young men. At the same time, it must be appreciated by the community that the function of the soil conservation service is to demonstrate and advise upon the necessary measures of prevention and correction—not to carry them out. Queensland is a vast State with less than two persons per square mile, while the United States has nearly 50; it would obviously be difficult to provide a service on the United States pattern in Queensland.

New Crops.

Less than one half of one per cent. of Queensland is under cultivated crop and there is room for great expansion of agricultural production both by the extension of old crops and by the development of new ones. In this connection it is apparent that the diminishing gap between the wages paid to white and coloured labour, and the increasing degree of mechanisation, will make it possible for Queensland to produce an increasing number of commodities hitherto regarded as the close preserve of countries employing coloured labour.

The development of a new crop, particularly if it is markedly different from the staple crops, requires a great deal of careful investigation of its climatic, cultivation, and harvesting needs, pest and disease problems, and the storage, processing and marketing of the product. Such investigations, or the development of new methods for old crops, require concentration and specialised knowledge; they do not proceed very fast if they are merely incidental to a thousand and one jobs. Consequently there has comparatively recently developed in the advanced countries of the world a new profession, that of "Agronomist."

In order to provide the staff facilities for such investigation of new methods and new crops, and collaboration with the advisory staff, a Senior Agronomist and two Assistant Agronomists have been appointed to the Agriculture Branch; two holders of Departmental scholarships at the University have just taken up duties. Later it is hoped to build this agronomy staff to about eight.

New crops developed during the war were grain sorghum, ginger, and canning beans. An active plant breeding programme is now being pursued so as to extend the range of growth of grain sorghum; ginger cultivation followed the cessation of supplies from China and a processing factory has been established at Buderim. Linseed was expanded from less than 200 acres in 1947 to 5,500 acres in 1948 and approximately 10,000 acres in 1949. Cultivation of a dwarf-type sunflower (suitable for harvesting with wheat harvesters) shows promise on the Darling Downs and is increasing. Attention is now being given to rice production and the possibilities of tea are being explored.

Seed Certification and Pedigreed Stock.

Official testing of seeds for germination has long been adopted but, short of growing a plant, there is no means of telling whether it is true to type. Consequently there has been initiated a seed certification service whereby seed is grown and harvested under the supervision of Departmental officers who can then certify as to trueness to type. Such certification is being made for seed of hybrid maize, grain sorghum, Sudan grass, beans, tomatoes and papaws; in addition a seed selection service for wheat growers is provided in co-operation with the Wheat Board, and all cotton seed is selected by Departmental officers. A large proportion of the tobacco seed is selected and distributed by the Agriculture Branch and the bulk of Queensland peanuts is grown from selected seed.

In order to achieve uniformity of product a selection has been made of stock of the smooth-leafed pineapple and this pedigreed stock is now ready for distribution to approved propagators from the Horticultural Experiment Station at Nambour; a similar service is being developed for avocadoes. The distribution of certified citrus budwood has been in operation for some years.

The most spectacular advance arising from this system of selection and certification has been made in tomato production. The four certified strains now recommended for the Stanthorpe district have yielded up to six times as much as the old standard varieties when grown side by side with them. A similar investigation has been started at Bowen.

Market and Crop Reports.

There is much more to farming than growing crops successfully; farming can be a successful business only if, in addition, crops are grown

when and where needed and are marketed under the best obtainable conditions. To achieve this end it is essential that the farmer have reliable information as to supply and price trends. On the other hand, the services rendered to the farmer by merchants, financial houses, and transport agencies can be more efficiently provided on the basis of advance knowledge of production trends.

Daily market reports were instituted in 1947, and comprehensive reports on prices and quality of fruit, vegetables and farm produce sold in the metropolitan markets are compiled and issued before noon each day. These reports are accepted as standard quotations.

Monthly reports on production trends, commenced in 1946, are much in demand by farmers, Government Departments, and commercial houses. They are compiled from the reports of the many Departmental field officers, Marketing Boards, and correspondents.

Individual crop forecasts are also issued as compiled. These crop forecasts are based on an Honorary Crop Correspondent scheme and have obviously been much appreciated. Public spirited correspondents representing particular areas submit reports on the extent of plantings and progress of crops and from this information forecasts (which are proving to be very reliable) are made. So far the service has been limited to certain major crops but it is being extended gradually.

Staff Training.

The training of staff today determines the calibre of tomorrow's services to the man on the land. The training of juniors has been greatly facilitated by the development of experiment stations distributed through the State; the value of this opportunity for experience in practical farm operations cannot be over-emphasised.

Since the war organised schools for field officers have been conducted at Head Office by senior scientific personnel. These schools have covered the general subjects of agriculture, horticulture, cattle husbandry, sheep husbandry, poultry raising, and control of diseases of stock.

Central Publicity Services.

The "Agricultural Journal" has for over fifty years been the main vehicle of publicity for the Department. With the increase of research work it was felt that one Journal could not satisfactorily serve as both a research and an extension publication, and in 1943 the "Queensland Journal of Agricultural Science" was launched.

A weekly "News Bulletin" was inaugurated in July, 1949, and is issued to the metropolitan and country press and radio stations; this deals with subjects of educational and topical value. In addition, special press releases on subjects of interest to residents of city and country are made almost daily.

Field days have proved a valuable extension medium and in association with the Queensland Dairymen's Organisation and other organisations of primary producers they are now being held on an extended scale. During the year 1948-49 some 65 field days were conducted by Departmental officers.

Wireless, a modern and powerful medium for extension activities, has been exploited and each year about 60 talks are given by Departmental officers.

Soil Conservation in Queensland.

J. E. LADEWIG, Senior Soil Conservationist, and A. F. SKINNER, Soil Conservationist.

1. The Erosion Problem.

SO much has been written and spoken of soil erosion in recent years that it is scarcely necessary to attempt any definition at this stage. However, it is as well to bear in mind that, when reference is made to erosion, it is accelerated man-induced erosion which is normally meant nowadays

Natural erosion, by means of which rocks of the earth's crust are broken down to form fine particles of soil which are subsequently transported to new sites, is a most important and generally speaking a wholly beneficial phenomenon. It is a slow and essentially ultimately a building process.

Man-induced erosion, on the other hand, is a rapid degradation process, destructive instead of constructive, and as such must be arrested or at the very least retarded if our civilisation is to be retained.

In order to avoid the cumbersome use of terms when erosion is discussed in this series of articles it is to be taken as meaning man-induced erosion and will be prefixed by the word "water" or "wind" to indicate the chief agency by which it is being effected.

Man-induced erosion is not, as many believe, something new, but to-day the problem has aroused the interest of many thinking people throughout the world, because it is realised that our future existence depends upon the preservation of the vital resources of soil, forests and water.

World-wide surveys of the total available area of land suitable for the production of food and clothing materials have indicated that urgent steps must be taken if the rapidly increasing human population is to be adequately clothed and fed in the future, and these steps must include measures to mitigate soil erosion.

The extent and the fertility of arable land in Queensland are at present more than adequate to provide all the essential requirements

for the present population, but evidence of serious erosion damage has already become apparent. The immediate introduction of soil conserving methods of land utilisation is essential if the land resources are to provide a satisfactory standard of living for the future population of this State.

Queensland has a serious water erosion problem affecting both agricultural and pastoral lands, but fortunately the incidence of wind erosion is restricted to isolated parts of the west of the State and is comparatively unimportant. These articles will therefore deal mainly with conditions influencing water erosion in Queensland, and will outline the measures necessary to prevent and repair such damage.

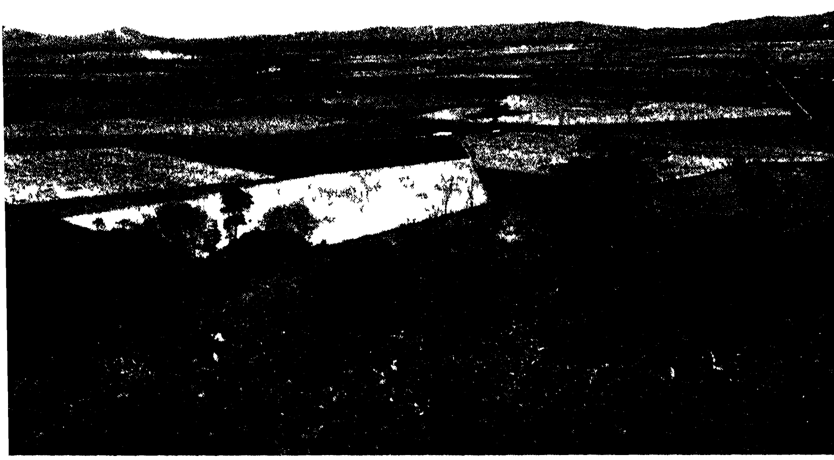


Plate 8.

THESE ALLUVIAL FLATS OF THE NORTHERN COASTAL PLAIN HAVE BEEN FORMED THROUGH THE AGENCY OF GEOLOGICAL EROSION.

HISTORICAL ASPECTS OF SOIL EROSION.

Prior to the settlement of land by civilised races, the protective nfluence of vegetation preserved nature's balance between soil formation ,nd erosion, and the soil resources increased through the almost mperceptible agency of geological erosion.

The practices adopted in the establishment of civilised communities roduce conditions of instability, rendering the soil vulnerable to rosion. In some regions the topsoil now lost in one year through man-nduced erosion is greater than was created in 1,000 years by geological rosion.

In the past, cities and civilisations have declined and vanished as a esult of erosion; the ruins of some of these now lie buried beneath feet f earth in Mesopotamia and Syria as testimony of the disastrous effects f this insidious menace.

Erosion is not, however, confined to the past but is rampant in countries which are still historically young; in the United States of America, South Africa and Australia, erosion has followed the rapid exploitation of natural resources; the insatiable urge to exploit virgin land has led to the indiscriminate destruction of nature's protective devices and in many cases this has been aided by the unwise use of modern farm machinery.

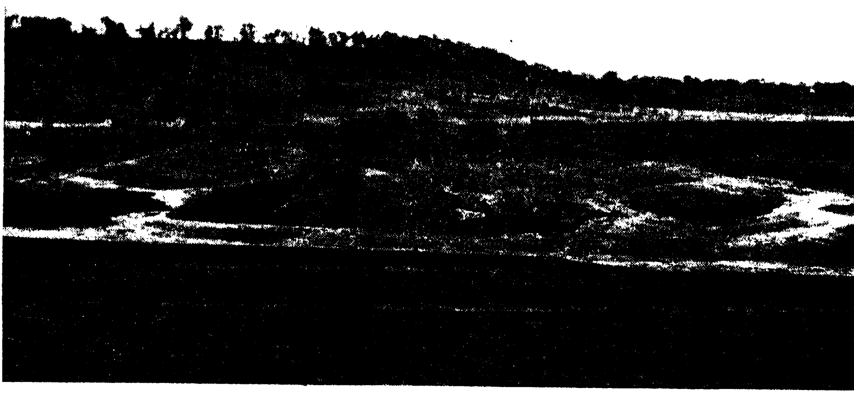


Plate 9.

EROSION ON THE FARMING LANDS OF THE EASTERN DARLING DOWNS.—Soil loss in this way is less spectacular than by gullying, but is just as serious.

In the United States of America an aggregate of 50 million acres of land is so badly eroded that it has been abandoned, and a further 250 million acres are subject to erosion in varying degrees, all requiring urgent treatment. In 15 years nearly 100 million acres of this land have been safeguarded by the application of soil conservation practices.

The New South Wales Soil Conservation Service reports that, as a result of a recent survey in New South Wales in the Eastern and Central Divisions, it has been shown that over half-a-million acres of once fertile land are beyond economic reclamation, and 20 million acres are rapidly becoming unproductive; a further 20 million acres have been affected by sheet erosion or by moderate wind erosion.

Soil erosion is similarly presenting problems in all other States of the Commonwealth, and appropriate measures are being taken by the soil conservation authorities of each State to meet the threat.

EROSION IN QUEENSLAND.

Erosion surveys of the agricultural areas of Queensland are not complete, but there is ample evidence that soil erosion is widespread in the State and that its incidence is rapidly increasing.

A Bureau of Investigation survey of the Darling Downs has shown that at least 40,000 acres have been withdrawn as useless for further cultivation; an additional one-and-a-half million acres are subject to erosion to some degree. The survey report states that, at the present rate at which erosion is ravaging the undulating portions of the Downs, it appears certain that unless active control measures are soon adopted as standard practice, the productivity of increasingly large areas will be seriously impaired or completely lost.

In the South Burnett district an estimated total of approximately 100,000 acres of land is affected by erosion in some degree. The damage in this district is mostly from the less spectacular sheet erosion, but its effect on productivity is cause for grave concern.

Plate 10.
SERIOUS GULLY EROSION ON THE DARLING DOWNS.

Other areas showing evidence of declining productivity due to erosion include the Atherton Tableland, Stanthorpe district, West Moreton district, the near North Coast, undulating tobacco lands in the Mareeba-Dimbulah districts, undulating cane lands from Bundaberg to Cairns, and many of the coastal banana and pineapple areas. In general, throughout the State, all undulating arable lands are subject to some degree of erosion, and abandoned cultivation fields have been observed in all the main agricultural areas.

In the pastoral areas both sheet and gully erosion occur, though the former is having the more serious effect on productivity through the development of "scalded areas" which are devoid of vegetation. These scalds result from the erosive action of both wind and water combined, and now occupy comparatively large tracts of country, particularly in the far western areas.

Wind erosion is fortunately restricted to the pastoral areas; there are no extensive areas of arable lands in the State yet affected by this type of erosion because, in general, the soil types so far utilised for cultivation are not readily affected by wind action.

EROSION LOSSES.

A few inches of topsoil supports all life on earth; and, as each inch of this vital topsoil is lost, subsoil farming draws nearer. Subsoil will produce crops, but experience shows that its productive capacity may be only one-tenth that of topsoil, and rarely does it reach half that amount. There is a prevalent misconception that many Queensland soils are feet deep, but a chemical examination shows that even on the deep soils the readily available plant foods are situated in the surface 12 inches. These facts emphasize the necessity of preserving every inch of available topsoil, irrespective of the apparent soil depth.

In some Queensland agricultural areas, as much as one inch of topsoil is frequently lost in one severe storm; this inch required perhaps 500 to 1,000 years for its formation, and represents as much as 125 tons of productive topsoil which may never be replaced. Carried away in this topsoil are large quantities of plant nutrients; when one inch of a typical Darling Downs soil is washed from an acre of land, with it is removed:—

37 cwt. of organic matter;
2,100 lb. of calcium;
420 lb. of phosphate;
980 lb. of potash;
420 lb. of nitrogen.

Apart from the fact that the organic matter cannot be replaced artificially, the other losses, interpreted in terms of commercial fertilizers, may be stated as follows:—

34 cwt. of lime;
19 cwt. of superphosphate;
17½ cwt. of muriate of potash;
18 cwt. of sulphate of ammonia.

Although with this loss of topsoil goes man's chance of earning a living from the land, the effects of erosion damage do not stop even there; the soil thus removed from the farm silts the streams and reservoirs, and in the latter case not only is the water storage capacity considerably reduced but often the only suitable storage site on a stream is lost for ever.

WATER EROSION.

Water erosion is the term usually applied to the erosion of soil by the agency of water, and the older conception of this type of erosion envisaged the direct scouring action of a body of water moving down a slope at a velocity sufficiently high to dislodge soil from its site and transport it from the area; this is true, but it neglects the fundamental causal factor, which is raindrop impact.

Raindrop Splash on Bare Soil.

Recent observations on the action of raindrops indicate the importance of raindrops, singly and collectively, as a factor in the complicated picture of soil erosion. While a single raindrop possesses only a limited amount of energy at its point of contact with the earth, the accumulated effect of the innumerable drops in a rainstorm assumes considerable proportions.

On a soil unprotected by vegetation, or other cover, this energy is expended in the destruction of surface soil crumbs and in packing the particles closer together. Plate 11 shows that at the point of impact of raindrops on a bare soil surface, or soil covered by a thin sheet of water, droplets of water and particles of soil are hurled into the air, the extent of the splash being dependent on the size of the raindrops

Plate 11.

PHOTOGRAPH SHOWING THE ACTION OF RAINDROP SPLASH.—The straight lines are falling raindrops, and the curved lines are fragments of water and soil thrown into the air as a result of the raindrop impact. Exposure $\frac{1}{75}$ second. (Photo. published by W. D. Ellison in "Agricultural Engineering," April, 1944.)

and their velocity; the large drops of high velocity typical of Queensland summer storm rains cause much greater splash and soil disintegration than the smaller low-velocity drops which are typical of steady winter rains. On level land the droplets are evenly distributed in respect of the point of impact, but on sloping land a greater proportion of the splashed droplets and dislodged soil particles fall on the downhill side of the point of impact. It is estimated that, on a 10 per cent.

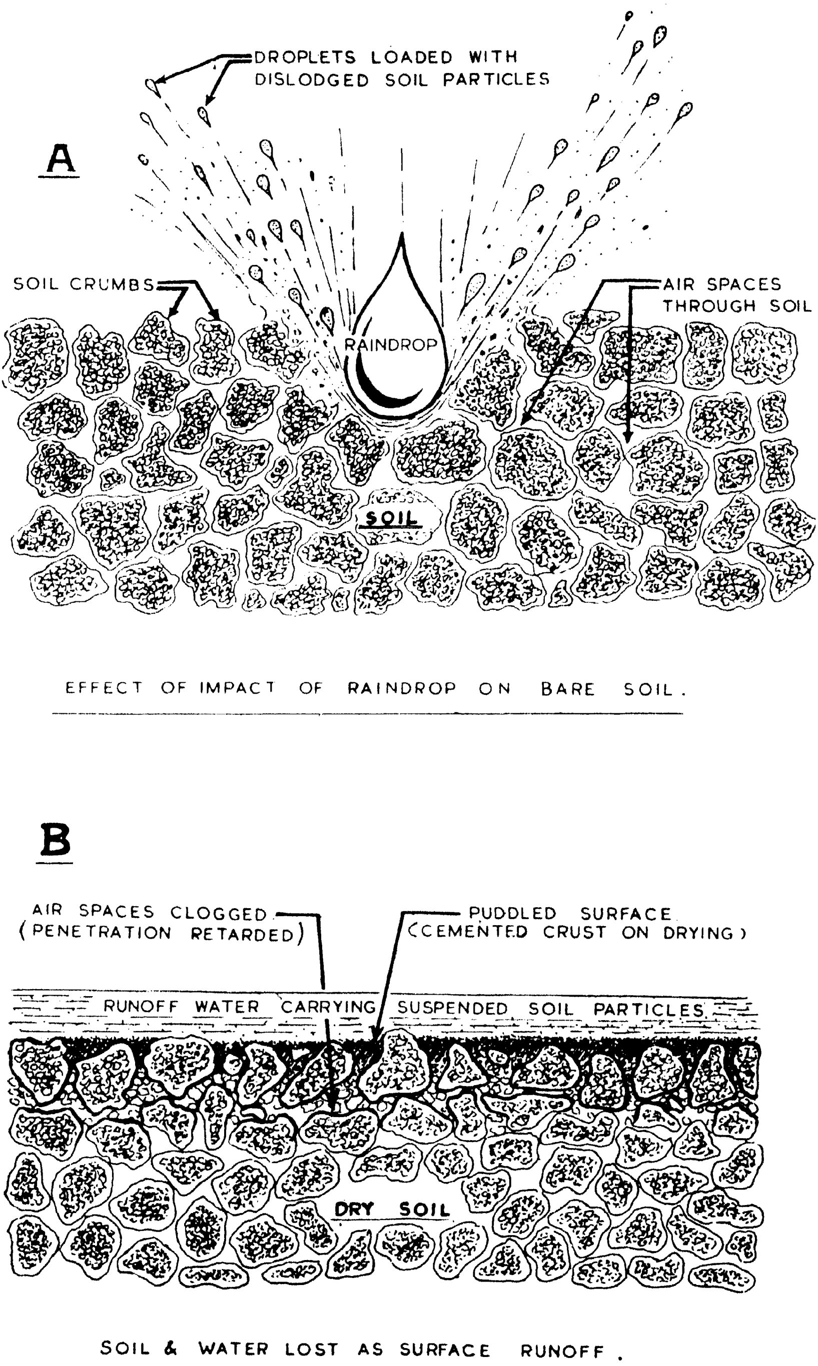
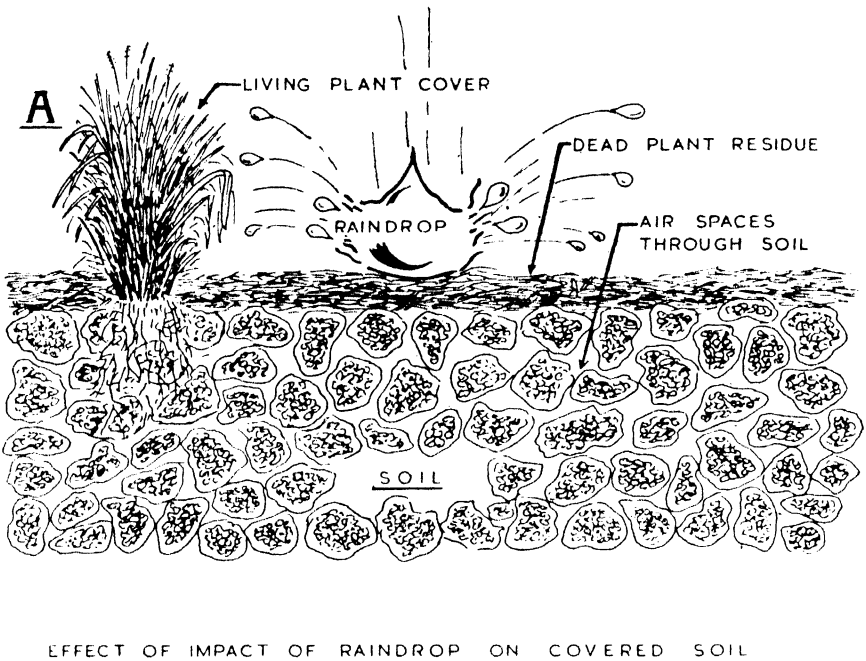


Plate 12.

SKETCHES ILLUSTRATING THE EFFECT OF RAINDROP SPLASH ON A BARE SOIL SURFACE.
(Sketches by A. F. Skinner.)



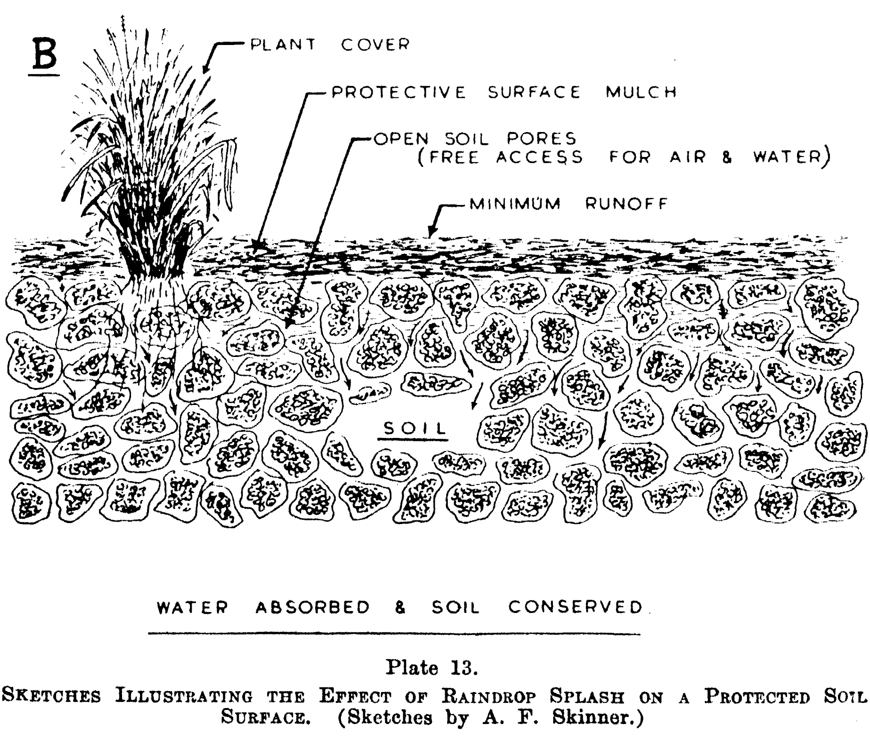


Plate 13.

SKETCHES ILLUSTRATING THE EFFECT OF RAINDROP SPLASH ON A PROTECTED SOIL SURFACE. (Sketches by A. F. Skinner.)

slope, three-quarters of the droplets fall on the lower side, and consequently a serious soil drift can result on bare cultivated hillsides from raindrop splash alone. The muddy water resulting from the disintegration of the soil crumbs flows into the soil pores, rapidly choking them and preventing the easy absorption of further rain. Although this dense surface crust may be only one-tenth of an inch thick, it is sufficient to influence the intake rate of the whole depth of soil; though the sub-surface layer of soil may be quite open in structure, the percolation rate is determined by the rate of entry through the surface crust. Plates 12 and 13 show the effects of raindrop splash on bare and protected soils.

Lowdermilk, in the United States of America, observed that a muddy suspension percolated through soil columns at about one-tenth the rate of clear water, the reduction being due almost entirely to the sealing of the surface layer of the soil; further, percolation did not improve when clear water was later applied unless the surface crust had previously been disturbed.

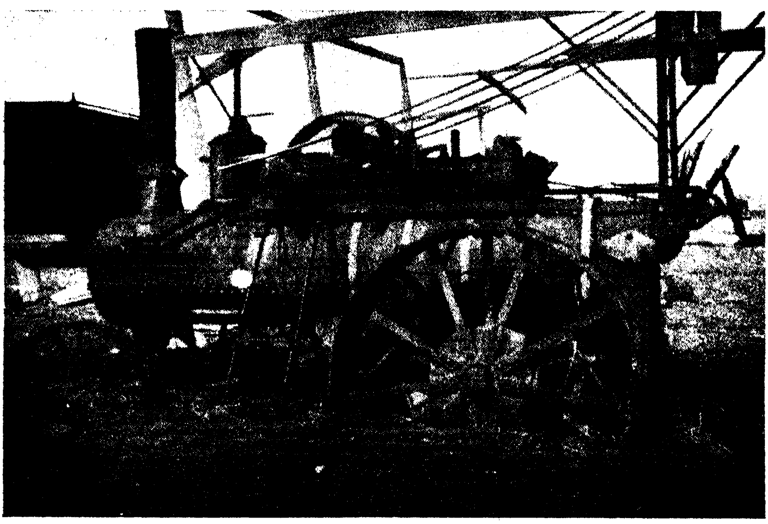


Plate 14.
EVIDENCE OF SHEET EROSION.

Run-off.

Because of the surface sealing on unprotected soils, the infiltration rate is reduced, run-off commences quickly, and large numbers of soil particles which have been disturbed by the raindrop impact are readily carried away in the water. The observed muddiness of run-off waters from bare soils was originally attributed to the scouring effect of water on bare ground; this is true to an extent, but it is certain that much of the suspended matter has resulted directly from the effect of raindrop impact.

Sheet Erosion.

As the depth of run-off increases, so does the velocity, until ultimately the run-off water is able to dislodge and transport soil particles; this velocity, coupled with the abrasive effect of the suspended soil particles, scours off the surface of the topsoil and so sheet erosion commences.

Since this type of erosion results in the removal of more or less regular but very thin sheets of soil, its development may proceed unnoticed for many years. For this reason, though it is the least spectacular of the various forms of water erosion, it is probably the most dangerous. On land of regular conformation it is possible for a foot or more of topsoil to be lost through sheet erosion without any evidence of gully development, or without attracting any attention whatsoever. Crop yields then decline, but this is seldom attributed to loss of soil; farmers then often refer to their soils as "worn-out", when in fact the correct term would be "washed-out".

The symptoms of sheet erosion are very obvious, however, and will be indicated by the extent to which soil has accumulated against lower fence lines or other obstructions (Plate 14).

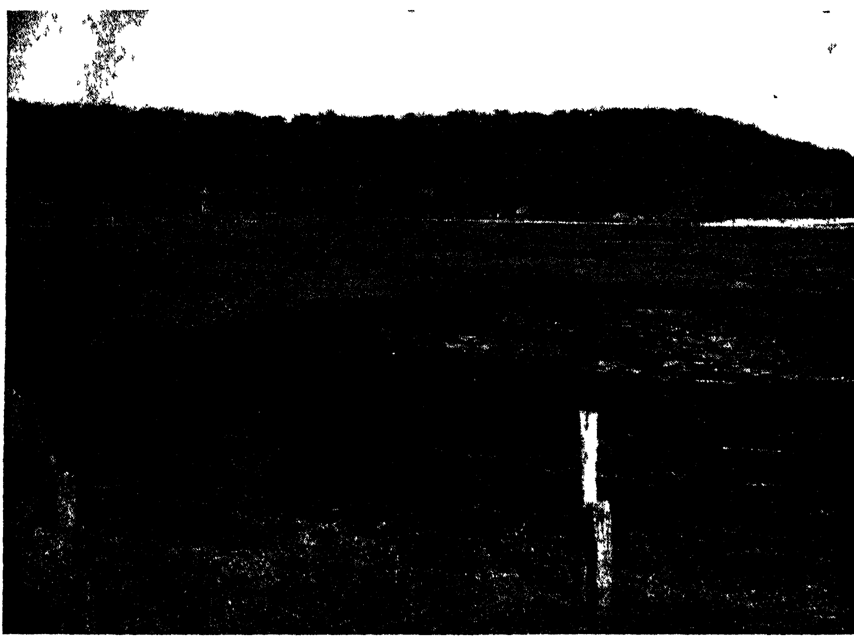


Plate 15.

SERIOUS SOIL LOSS BEFORE THE DEEP GULLY STAGE HAS BEEN REACHED.

Gully Erosion.

As sheet erosion proceeds, there is a tendency for the run-off water to accumulate in minor depressions on the land; this increased concentration of water results in the development of rills, and if no protective action is taken these ultimately become small gullies.

Usually, at some point in a gully a marked difference in height occurs, and this is generally at the point where it enters a watercourse. On erodible soils a steep face or "overfall" is developed, with the resultant tendency for the water to undercut the base of this wall, causing the rapid collapse of large masses of soil at this point. Once an overfall commences, the gully deepens rapidly, following along the line from which the water is entering. This completes the water

Plate 16.
PHOTOGRAPH SHOWING A GULLY OVERFALL.—This gully extended a further 30 feet towards the road in one series of rains.

erosion picture, but it is important to appreciate that the final awe-inspiring gully erosion has developed in successive stages from a bare cultivated soil exposed to the impact of raindrops.

Raindrop Splash on Protected Soil.

When a raindrop strikes land with an adequate protective cover, whether it be a mattress of dead crop residues, a living cover of crops on arable land, a carpet of grass on pasture land, or a forest with its associated ground litter, the initial energy of the drop is expended against the barrier of vegetation; the drop shatters and trickles through the vegetative covering and clean water enters the soil without obstruction. The raindrops carry no suspended soil particles, there is no surface sealing effect, and the rain rapidly enters the soil in accordance with the sub-surface infiltration capacity; if the soil is of good open structure, large quantities of rain can be rapidly absorbed.

Water commences to move down the slope much later in a storm than under the bare soil conditions described earlier; since the barrier of vegetation also hinders the down-slope progress of the run-off, greater opportunities for water absorption are presented and rarely is the run-off water able to attain sufficient velocity to cause scouring.

WIND EROSION.

Surface soil is moved by the agency of wind only where wind velocities at the ground surface are sufficiently high to dislodge and transport soil particles. With the exception of deserts, sufficient vegetation is normally present under natural conditions to obstruct wind flow and to reduce ground velocities to a point where soil cannot be transported.

The depredation of rabbits, and overstocking combined with adverse seasonal conditions, have each resulted in the decline of perennial plants in many inland areas. Once this protective cover is removed or reduced, and constant intense winds coincide with drought conditions, the topsoil is rapidly removed, and in some areas there is rapid formation of a hard impervious surface known generally as a clay-pan or a "scalded area". These areas, because of a higher clay content

Plate 17.

PHOTOGRAPH OF A SCALDED AREA IN THE SOUTH-WEST, FOLLOWING A VERY FAVOURABLE SEASON.—The sparse cover of annual herbage disappears in dry seasons. Note the islands of better vegetation where the topsoil has been retained.

than the original surface soil, are rapidly beaten hard by raindrop impact, and eventually present a surface which is unsatisfactory for the reception or retention of plant seeds or for the absorption of rain. In very favourable seasons annual plants may occur on these scalded areas only to die and be blown away in the next dry season; perennials are rarely established, because the low infiltration rate results in dry subsoil conditions unfavourable to these deeper rooted plants.

Wind erosion is usually restricted to the sandy and sandy loam soils; those with a high colloid content are not appreciably affected. Some of our pastoral areas are subject to this type of erosion, but, fortunately, because of soil type or climatic conditions, little agricultural land in Queensland is affected by it.

[TO BE CONTINUED.]

Agriculture, other than Sugar Culture, in the Mackay Area.

N. E. GOODCHILD, Senior Adviser in Agriculture

THE discovery and settlement of the Mackay district is of considerable historic interest. In 1860, a 21-year-old Scotsman, John Mackay, accompanied by a small party, set out from Rockhampton in an endeavour to locate a river that Leichhardt had reported. This river was believed to have a watershed between the Burdekin and the Isaac Rivers, and was supposed to flow into Repulse Bay. On May 16, the party reached the summit of the main coastal range and, quoting from John Mackay's diary, saw "a bold deep river with well defined banks, the landscapes on both sides being rendered picturesque by clumps of palms which appeared like sentinel giants keeping watch over the surrounding expanse of rich tropical vegetation unlike anything we had hitherto seen on our travels."

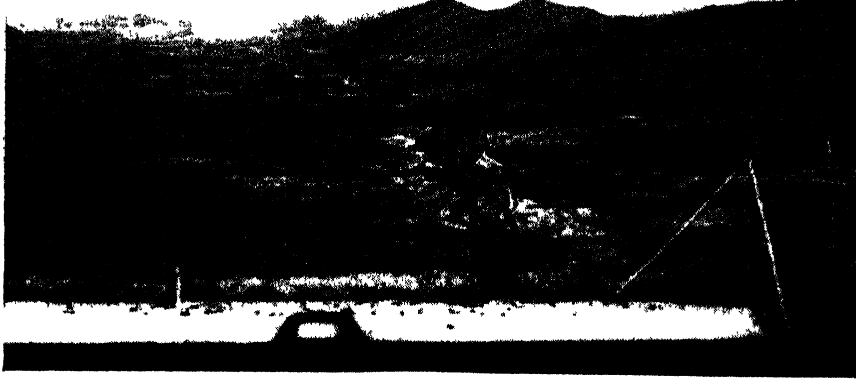


Plate 18.
PIONEER RIVER VALLEY, MACKAY DISTRICT.

The river, the valley of which is shown in Plate 18, was named Mackay. Later, Commander Burnett, navigating the coast in H.M.S. "Pioneer," observed that a river named Mackay flowed into Rockingham Bay and to avoid geographical mistakes renamed the river Pioneer. Mackay, however, received due recognition of his discoveries when the township was named after him.

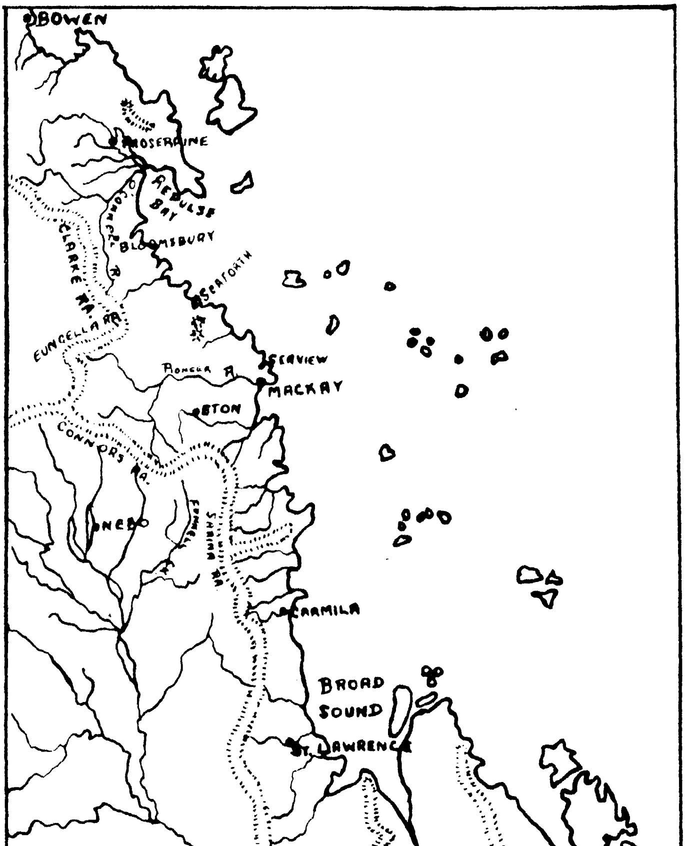


Plate 19.

SKETCH MAP OF THE ST. LAWRENCE–BOWEN AREA.

John Mackay acquired a lease of the Mackay river country and established himself on what is now known as Greenmount holding, 12 miles from Mackay, to which he brought 1,200 cattle and 50 horses. The leasehold on the northern side of Mackay river was later acquired by John Cook and is now known as Balnagowan. Further grazing areas were established along the coast as well as on areas west of the main coastal range. The pastoral industry was by then firmly established in one of the finest fattening areas of the State.

Although early settlers were cattlemen, it was soon realised that soil and climatic conditions were suitable for other forms of primary production. Maize, coffee, and cotton were grown with some degree of success. John Spiller, who had experience in sugar cane growing,

imported cane plants from Java, and in 1868 the first cane crops were harvested. Gradually the pastoral industry gave way to sugar culture on the coast but continued to expand in Mackay's hinterland.

Rapid increase in population provided an outlet for other agricultural and horticultural crops and their development was accelerated during the war years by the urgent need of essential food and increased milk supplies.

Plate 20.
EUNGELLA RANGE COUNTRY AFTER OCCUPATION.

For the purposes of this article the Mackay area is defined as that part of the coast and near coastal region of the State between St. Lawrence in the south and Bowen in the north; it includes the important primary producing centres of Mackay and Proserpine on the coast, and Nebo to the west of the main coastal range. The main features are shown in Plate 19.

The coastal range which extends along the coast from St. Lawrence to Dalrymple Heights is known as the Connors Range, and it continues north to Bowen as the Clarke Range. The width of the coastal margin between the coast and the range varies from eight miles at Carmila to 50 miles at Mackay. The eastern slopes of the coast range are covered by heavy rain forest. Coastal plains occur at St. Lawrence, Inneston, Proserpine, and Bowen.

The area is well watered by numerous short creeks flowing from the main coastal range to the sea, as well as by several rivers, including the St. Lawrence, the Pioneer, the Proserpine, and the Don. Eungella Range (Plate 20), 50 miles west of Mackay, consists of a rather narrow rain forest belt averaging 5 miles wide by 40 miles long, with an altitude ranging from 2,500 to 3,000 feet.

Sarina Range, with an altitude of 1,000 feet, contains a limited area of rain forest but is essentially undulating open forest country. The adjacent areas of Blue Mountain and Bolingbroke are of somewhat similar country. The Nebo area comprises undulating slopes and open downs with some broken country.

Land tenure varies in different districts. Fruit areas consist of freehold, perpetual lease, and agricultural farm tenures. Fruit farms are relatively small. They average about 30 acres in the Seaview area, 100 acres in the Seaforth area, and 160 acres in the St. Lawrence district. Dairying lands comprise perpetual lease holdings, agricultural farms, and grazing farms. The areas of the farms differ according to the fertility and carrying capacity of the country concerned.

On the Eungella Range, farms range from 180 to 300 acres in area, and in the O'Connell river area the holdings are of approximately 250 acres. The carrying capacity of these areas is comparatively high, due to the establishment of introduced grasses. A reliable carrying capacity on the Eungella Range rain-forest area is generally regarded as being one beast to 3 acres, whilst on the O'Connell River a reasonable carrying capacity is considered to be a beast to 3-4 acres.

The East Funnell Creek district comprises agricultural farms and perpetual lease selections. Here farms range from 700 to 1,200 acres in area. Introduced grasses planted on these holdings have improved the carrying capacity of the country, which is approximately a beast to 5-6 acres.

The Bolingbroke and Blue Mountain districts comprise agricultural selections and grazing farms which vary in size from 1,200 to 3,000 acres. The carrying capacity of these lands is lower than that of other dairying lands in the Mackay district. The country is generally regarded as being capable of carrying a beast to 10-12 acres.

CLIMATE.

The climate in the Mackay area is generally pleasant in the winter, but hot and humid in the summer months.

The rainfall distribution in the area is very variable, as shown by the following rainfall data for the main centres, which are given in points of rain based on 76-year averages:—

——	Mackay.	Bowen.	Proserpine.	St. Lawrence.	Nebo.
January	1,365	965	1,503	906	602
February	1,180	877	1,291	759	472
March	1,221	579	1,248	527	410
April	608	263	567	272	176
May..	382	125	420	174	122
June	274	163	330	247	185
July	167	93	158	136	125
August	100	62	135	78	65
September	163	78	199	122	105
October	173	99	160	180	107
November	307	128	285	240	202
December	692	430	731	464	394
Total	6,632	3,862	7,027	4,105	2,966

At St. Lawrence, in the southern portion of the area, the annual rainfall is 41 inches. This increases at Carmila to 56 inches, increases further at Mackay to 66 inches, and approaches 80 inches on the Eungella Range. There is a gradual tapering off at Proserpine to 70 inches and a rapid decline between Proserpine and Bowen, where the mean annual rainfall drops to 38 inches.

The sub-coastal rainfall recedes rather rapidly. The Blue Mountain and Bolingbroke districts register between 50 and 56 inches per year, while Nebo, 60 miles south-west of Mackay, receives only 29 inches.

Summer rainfall is usually reliable. "Wet season" rains may commence in December, but are occasionally delayed until February and sometimes as late as March. Long wet seasons periodically extend into April. Fair winter rains, sufficient to provide for winter pastures and fodder crops, often occur. Storm rains in the spring months are erratic and unreliable and usher in a dry spell not unusually extending into November and sometimes into December.

Excessive precipitations in the summer months occur in the Mackay-Proserpine area from time to time, causing waterlogged conditions, leaching of soil nitrates, and a check to plant growth. Under such conditions, agricultural crops are detrimentally affected during the wet period.

Provided crops are planted and a good root system established prior to the wet season, satisfactory growth may be maintained. The coastal areas of Sarina, Mackay, and Proserpine have a reasonably reliable growing period of approximately six to seven months.

The distribution of rainfall has an important bearing on crop production. For example, in the 1948 season, when only 29 inches were registered during the first seven months of the year, potato crops were harvested which yielded considerably in excess of any previous year's production. Pastures also were palatable over a greater period with the diminished rainfall.

SOILS.

The agricultural soils are varied and patchy in the Pioneer Valley. They consist largely of river and creek alluvials and red volcanic soils, grey clay flats and brown loam ridges. On the Eungella Range, the principal type is a red and yellow granitic soil, while there is also an area of red volcanic soil on the plateau. Carmila and Sarina valleys comprise two main types—namely, alluvial flats and brown loam ridges.

Agricultural land in the O'Connell River area is restricted by the somewhat broken country. The limited flats are alluvial and the slopes red volcanic and granitic soils.

In the Proserpine area, the principal types are heavy black loam alluvial flats, with red volcanic soils in the scrub belt. Soils at Bowen include heavy grey clay alluvial flats, with areas of sandy loam adjacent to the Don River.

Open downs country extends to the coastal areas at St. Lawrence, Inneston, Eton, and Proserpine, and consists of brown and black loams. In the Nebo area, brown, chocolate, and black soils occur extensively on the open downs, and brown and chocolate loam soils on the undulating slopes. Adjacent to the Isaac River, sandy loam flats extend back to sandy flat country.

The more fertile soils are associated with the various creek and river flats and the broken country originally covered by rain-forest.

Considerable areas in this district are flat, poorly drained lands with impervious clay subsoils, and are unsuitable for general agriculture.

Soil erosion is not serious on the flat lands used for general agriculture but is apparent wherever slopes are cultivated. Some difficulties, however, have been experienced by erosion along the river and creek banks due to destroying timber and cultivating land to the edge of banks. During the course of time, timber growth has developed in the river and creek channels, obstructing the free flow of water and causing an accumulation of debris, resulting in diversion of the normal course. Lower creek and river terraces are then periodically flooded.

In the absence of timber and other vegetation to hold the soil, considerable erosion has taken place, particularly along Cattle Creek, but corrective measures are now being undertaken in this area. Already approximately 25 miles of creek and river channels have been cleared and banks stoned where erosion has occurred. On the lower terrace it is impossible to prevent flooding, and in such areas fallowing of land during the rainy season should be avoided.

WATER FACILITIES.

The coastal belt is well served by numerous creeks and rivers, most of them permanent streams, which flow from the coastal ranges to the coast. The water is of excellent quality for stock and irrigation purposes. Ample supplies for stock are obtainable at from 25 to 50 feet. The extent of the underground water supplies is at present under investigation, but there is a considerable variation in supplies throughout the district.

Located in various portions of the district are some 120 irrigation plants on general agricultural and horticultural farms irrigating from 2 to 20 acres per plant. Water supplies are obtained from creeks and rivers as well as from bores and wells and by duplicated spear systems. Almost invariably the overhead sprinkler system operates, and little or no flood irrigation is practised. The various types of plants are utilised for the production of such crops as potatoes, tomatoes, truck crops, oats, maize, sorghum, lucerne, bananas, pineapples, and pastures. The maximum advantage is gained in the winter and spring months when natural rainfall is less reliable.

A striking feature in the Nebo area is the lack of surface water other than the good supplies in Lake Elphinstone. Water is, however, readily available at a shallow depth in the sandy creek beds and in the Isaac River. Water supplies on the downs country are more difficult and it is necessary to bore 150 to 500 feet. Boring has not always proved successful and in such cases large dams varying in size from 10,000 to 30,000 cubic feet are sunk. These dams when filled usually hold for at least 12 months.

There are several irrigation plants in the Nebo area—on the Isaac River; on Nebo Creek; on Cooper's Creek; and on the Bowen River. Irrigation is used mainly for the production of fodder crops, such as maize, sorghum, oats and lucerne, and to a limited extent for vegetable production for home consumption.

In the Bowen area ample supplies of water are available at shallow depths for irrigation in the Delta region and numerous plants operate from the Don River. The main crops in this area are tomatoes, cucumbers, and pumpkins. A small amount of tobacco is grown.

(TO BE CONTINUED.)

The Avocado in Queensland.

R. L. PREST, Senior Adviser in Horticulture.

THE avocado has for many years been a staple food of the natives in Central and South America and the West Indies. From there it was introduced to the United States of America, where it is now extensively produced commercially. The fruit is pear-shaped in some varieties and because of this it is sometimes referred to as the avocado pear. The fleshy, edible portion inside the skin of the fruit may be upwards of an inch in thickness, and normally surrounds a single large seed. When ripe, the flesh has the consistency and colour of butter, possesses a rich, nutty flavour, and in the best varieties has a fat content of about 25 per cent. The flesh may be eaten fresh with the addition of pepper, salt, or vinegar, while it is a tasty addition to green vegetable salads.

In the commercial sense, the avocado is a comparatively new fruit in Queensland. The history of its introduction is somewhat obscure, but records indicate that the earlier introductions were planted as seedlings about 30 years ago. Many of these trees are still fruiting.

Avocadoes may be grown successfully on good soils along practically the whole of the Queensland seaboard. Trees (Plate 21) planted in the foothill districts along the lower north and south coasts and in northern Queensland have grown vigorously and some are now in heavy bearing. These trees were mainly grown from seed introduced from time to time by the Department of Agriculture and Stock and the Queensland Acclimatisation Society. In recent years, budwood and grafted trees of promising varieties have also been imported from the United States by private individuals, while selections from several locally-raised seedlings of excellent quality have been propagated.

BOTANICAL RELATIONSHIPS.

Botanically, the avocado belongs to the genus *Persea* and is a member of the laurel family. The home of the cultivated species is generally conceded to be Central and South America.

Avocadoes are grouped into two species belonging to three races, known respectively as Guatemalan, West Indian, and Mexican. The Guatemalan race matures its fruit in winter and spring, while the other two mature their fruit in summer and autumn. The fruit of the Mexican race is usually smaller and thinner skinned than that of the others.

The avocado is an evergreen, though some varieties are virtually leafless for a short period during blossoming. The habit of growth is variable, some trees being tall, upright, and unbranched, while others are small, well-branched, and spreading. The leaves also vary considerably in size and shape. Young foliage often exhibits various shades of red and bronze, but when mature it is usually bright-green in colour.

The flowers are borne in terminal clusters; they are small and pale-green or yellowish in colour.

Plate 21.
AVOCADO TREE IN BLOSSOM.

The fruits of different varieties (Plates 22, 23, and 24) vary greatly in size, shape, and colour. In shape they may be round, oval, pear-shaped, or of any gradation between these forms. The colour may be light-yellow, green, dark-green, maroon, purple, or purplish-black.

SOIL REQUIREMENTS.

In Queensland, the avocado thrives on a comparatively wide range of soils.

The ideal soil for avocadoes is a loam of medium texture overlying a moderately heavy but porous subsoil which, in turn, overlies a gravelly wash. In no circumstances should trees be planted on poorly-drained soils, as the roots are extremely sensitive to excessive moisture and the trees quickly succumb to "wet feet."

Some of the loams of basaltic origin on the coastal ranges and the sandy loams along the foothills are excellent. The more sandy soils,

reddish to brown in colour, occurring in the lower north and south coast districts are often too well-drained and, unless they can be irrigated, are often unsuitable for fruitgrowing. Where the subsoil at 18 to 30 inches deep is compact and deep red in colour, these soils are capable of growing good fruit.

Heavy clay soils and the grey sands found in lowlying areas should be avoided.

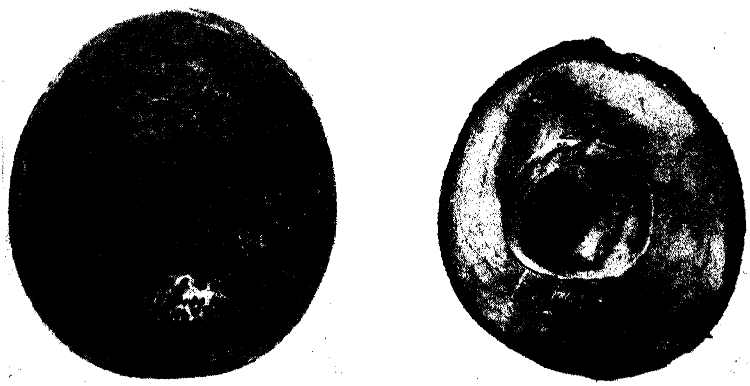


Plate 22.
NABAL AVOCADO FRUIT.

CLIMATIC CONDITIONS.

As the avocado is a sub-tropical fruit, its commercial culture must necessarily be confined to tropical and sub-tropical regions. In practice, it has been observed that the trees do not tolerate low winter temperatures, high spring and summer temperatures, low atmospheric humidity during the blossoming and fruit-setting period, and heavy winds.

ORCHARD LOCATION.

Avocadoes thrive best in frost-free, well-sheltered, warm situations. If winds are likely to interfere with normal tree growth, belts of standing timber should be retained for protection where practicable. In districts denuded of the natural timbers, shelter belts should be planted.

The orchard site should be an area of unbroken, nearly level, or gently sloping land. Steep hillsides should be avoided, for, in addition to the risk of irreparable losses by soil erosion, costs of cultivation are excessively high.

Where hillside orchards are contemplated, contour planting should be undertaken, the contour grade varying from 1 to 3 per cent., according to the length of the tree rows.

POLLINATION AND VARIETIES.

Avocado flowers (Plate 25) have two distinct opening periods, one during the morning and one during the afternoon. All varieties fall into one or other of two flowering groups, which, for convenient reference, have been designated A and B

Plate 23.
FUERTE AVOCADO FRUIT.

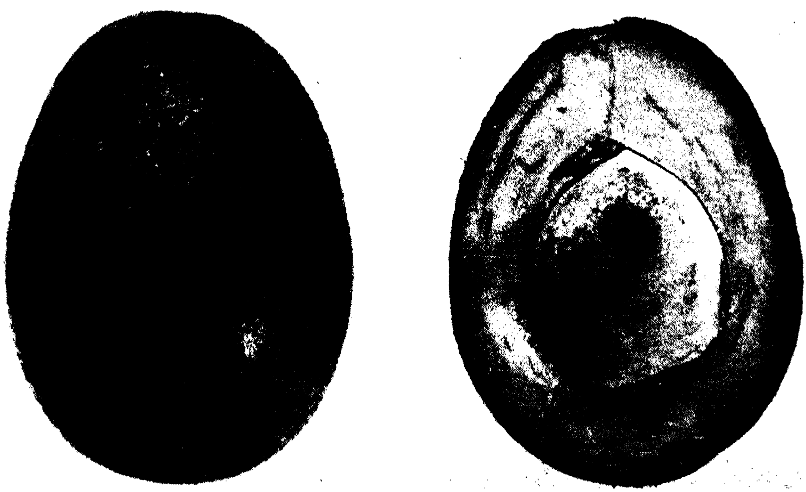


Plate 24.
ANAHEIM AVOCADO FRUIT.

Observations have shown that the flowers of varieties in group A open for the first time in the morning and are then receptive of pollen. They close usually between noon and 2 p.m. and open a second time during the afternoon of the following day, when the anthers burst and pollen is shed. The flowers of varieties in group B open for the first time in the afternoon, when they are receptive, and open a second time the following morning to shed pollen.

It is probable that when one or more varieties selected from each of these two groups are interplanted fruit-setting will be improved.

Until more information is available on varietal behaviour in Queensland, commercial plantings should be restricted to Fuerte (a hybrid type), Nabal (a Guatemalan type), and Anaheim (also a Guatemalan type). Anaheim produces a small fruit and is normally planted at the rate of 1 tree to 9 of the other two. Such plantings may meet cross-pollination requirements where these are necessary and give a tolerably long spread in the harvesting period, which is desirable in commercial practice. The habits of each variety are as follows:—

Plate 25.
AVOCADO BLOSSOM.

Fuerte (Hybrid).

Tree straggling, spreading; blossoms very early in July and August; fruit pear-shaped, oblong, base somewhat pointed, apex obliquely flattened; green with numerous yellow dots, pebbled; skin thin, pliable, leathery; flesh creamy-yellow, greenish near skin, texture buttery, very rich flavour, quality excellent; seed tight in cavity; matures April and May; pollination group B.

Nabal (Guatemalan).

Tree well branched, spreading; blossoms late October and November; fruit almost round, smooth, green in colour; skin thick, granular; flesh creamy-yellow, buttery texture, greenish near skin; flavour exceptionally good; quality excellent, seed small, tight in cavity; matures October and November; pollination group B.

Anaheim (Guatemalan).

Tree tall with upright growth; blossoms midseason, September to October; a prolific bearer, though the fruit is easily shed; fruit elliptical; skin rough, glossy, green; flesh creamy; flavour good; seed medium size and tight in cavity; matures during July and August; pollination group A.

PROPAGATION.

Raising the Seedlings.

Seed should be selected from matured fruits of healthy, vigorous seedling trees, and should be washed, cleaned, and planted as soon as possible after removal from the fruit.

The seed is planted in seed boxes or seed-beds containing a mixture of equal parts of clean sand and loam. The seeds are placed in the soil with the base down and with the apex just protruding above the surface. The soil should be kept moist, but not soaked. During hot weather, shading will be necessary; hessian or lath screens are useful for this purpose. Under favourable weather conditions, germination will take place within a few weeks.

The seedlings should be transferred to nursery rows when they reach a height of 6 to 8 inches. Care should be taken to prevent root damage during transplanting because avocado seedlings have a particularly long tap root. In the nursery, the plants are set out 12 to 18 inches apart in the row, the rows being 30 to 36 inches apart. Immediately after planting, the seedlings should be watered. Temporary protection from the sun is necessary; shading on the north-eastern side is particularly advisable. Frequent waterings are again necessary.

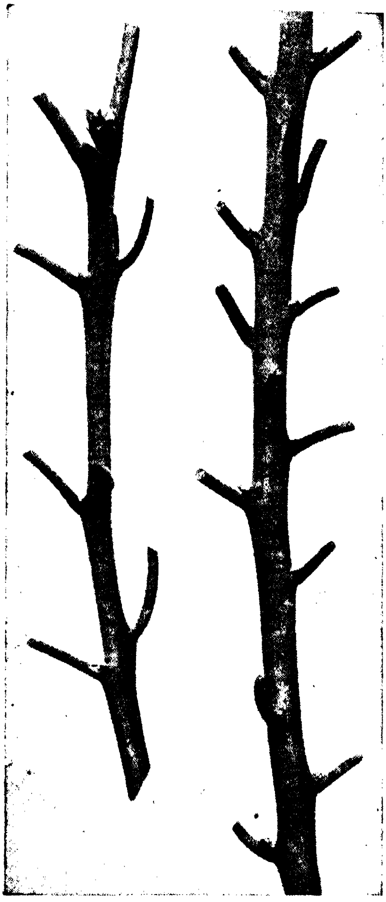


Plate 26.

AVOCADO BUDSTICKS. Left—Suitable for bark graft. Right—Suitable for T budding.

Budding.

When the seedling stocks have attained a diameter of about three-eighths of an inch at their base and the sap is flowing freely, they may be budded. In Queensland, this is usually done during autumn or spring. When the stock is ready to receive the bud, a "T" cut is made in the bark 6 to 8 inches above the ground level. The perpendicular cut should be 1½ to 2 inches long and should penetrate just through the bark to the cambium layer. The "T" cut should be made preferably on the southern side of the stock, where the bud will not be exposed to the sun.

Budding requires rather more care in avocadoes than in some other fruits because, while the union of the stock and scion takes place readily enough, the bud often fails to grow and the eye falls out. It is necessary, therefore, to use only the plump full buds in the middle of the bud stock. (Plate 26.)

The bud may be cut from either above or below, the general practice being from below the bud upwards, commencing from ¾ inch to 1 inch below the bud and ending from ¾ inch to 1 inch above it. A sharp, thin-bladed knife is used to make the cut, which should be just deep enough to remove a thin layer of wood. The bud is inserted in the "T" cut in the stock and gently pushed down between the bark and the cambium layer. The bud and stock are then bound closely together with raffia. About three weeks are required for the bud to unite with the stock. During this period the tie should be inspected frequently; where bulging appears, the tie can be loosened to prevent restriction.

As soon as the union takes place, the stock may be headed back a few inches in order to force the bud into growth. The ties are not removed from the union until the bark flaps have entirey healed over, which is usually 6-8 weeks after budding.

As soon as the bud has made 3 or 4 inches of growth, it should be first tied to the stem of the stock and later trained to a stake. The final removal of the stock stub may be done when the bud shoot is 12 to 18 inches long and capable of remaining erect. The cut is made at a slope just above the union, and should be sealed with Bordeaux paste or lime sulphur.

REWORKING.

In Queensland avocado plantings, there are some unprofitable types of seedlings which can be reworked to good commercial varieties. Reworking by means of bark grafting has been successful, but, as with budding, should only be done—except in the case of large trees or trees with no branches close to the ground—during the growing season when the sap is flowing freely.

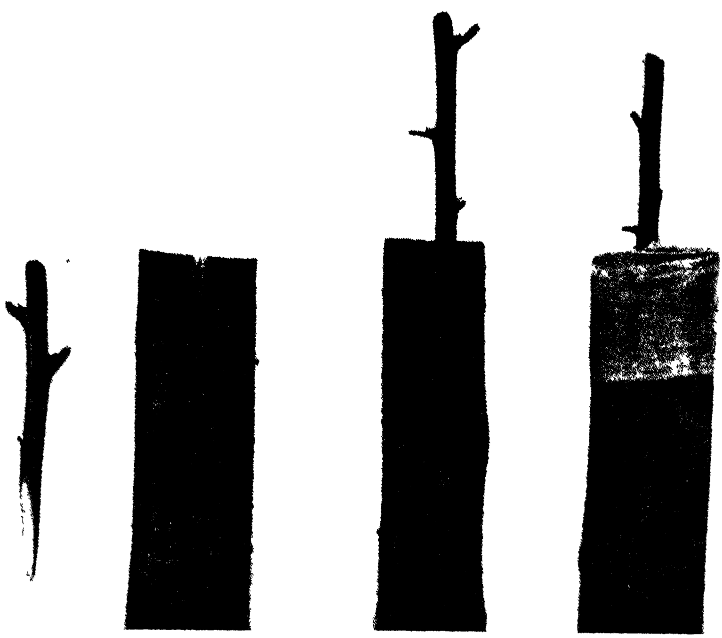


Plate 27.

BARK GRAFTING THE AVOCADO. Left to right—scion prepared for insertion; bark opened to receive scion; scion inserted under bark; graft completed and tied.

When using the bark graft, three or four limbs evenly spaced round the trunk of the tree are selected and sawn off square about 2 or 3 feet from the trunk. The cut surfaces should be smoothed over with a sharp knife and two scions inserted opposite each other in each limb. If both scions grow, the weaker one may later be removed. The scions are easily inserted by making a cut about 3 inches long for each scion through the bark at the end of the stumps and then pushing the scions down between the bark and the wood (Plate 27).

The scions are selected from well-matured second-growth wood, the terminal growth being discarded. Each should contain two or three plump buds, which at the same time are not too far advanced. Where

possible, it is an advantage to include a node, as adventitious buds often develop from this zone. The scions are prepared by making a long sloping cut about 2-2½ inches long on one side. The cut surface is inserted next to the wood, or more correctly, the cambium layer. When the scions have made good growth, the remaining branches of the tree, which have not been cut back for grafting, may be completely cut away.

Large trees, or trees with no branches within 3 or 4 feet of the ground, require slightly different treatment. During winter, when the trees are dormant, the whole of the top of the tree may be removed by sawing through the trunk at a height of 3 feet from the ground and at the beginning of spring inserting three or four scions under the bark. Two of these, or at most three in the case of very large trees, may be allowed to grow.

Plate 28.

NEWLY PLANTED AVOCADO TREE WITH PROTECTION FROM SUN AND WIND.

PLANTING.

On level land and gently sloping land, orchards are generally laid out on the square system. On the steeper hillsides, contour or modified systems of contour plantings should be adopted. When planted on the square system, the planting distances are 30 feet by 30 feet; avocadoes are vigorous-growing trees and require plenty of room.

The union of the stock and scion is always a weak spot in a tree (Plate 28) and should, therefore, be kept above the level of the soil. If the land has been properly prepared there is no need to dig big holes for the trees. So long as the holes are wide enough to spread the roots, they need not be more than 12 inches deep. The roots should be evenly spaced at a downward angle of about 45 degrees, and the hole then almost filled with fine topsoil and tramped firmly. Before the hole is completely filled, the application of 3 to 4 gallons of water to each tree is desirable.

The season of planting may be governed by local conditions. Spring plantings often entail frequent waterings, as the young trees should never lack moisture. Planting in February during the wet period, therefore, is often preferable.

CULTIVATION.

Cultivation to suppress weed growth is important during the drier spring months. Summer and autumn rains are utilised for growing green manure crops, which, however, should be ploughed or disced in not later than the middle of July. Such crops both improve the physical condition of the soil and reduce soil losses by erosion.

In young avocado orchards, cultivation to a depth of 8 to 10 inches is advisable. However, as the trees become older, their rooting systems extend widely in all directions and shallower cultivation is preferred, particularly close to the trees.

Avocado trees up to two or three years old occupy a relatively small proportion of the total area on which they are planted, and thus the early years of an avocado plantation afford an excellent opportunity for building up a reserve of organic matter in the soil. At this stage, cultivation, even early in the season, may be confined to the immediate vicinity of the trees, the space down the middle of the tree rows being occupied by a succession of summer and winter green manure crops, each of which is turned under as it approaches maturity.

PRUNING.

The avocado tree requires little or no pruning once its framework has been established. In general the aim should be to establish a strong, symmetrical tree having well-spaced branches which will support heavy crops of fruit.

At planting, the young tree should be headed back just above the strongest of the dormant buds which terminate the growth cycles of the trunk. These buds usually make upright growth. Subsequent pruning consists in pinching out terminal buds and the removal of crossing and crowding branches. The kind and amount of pruning differ with varieties. Trees of a straggling and spreading habit should be pruned to direct the growths upwards. On the other hand, tall-growing varieties require to be topped and cut to buds pointing outwards to preserve low heads. As the trees grow older, the lower limbs are shortened back and finally removed to make room for the upper larger ones which bear down.

HARVESTING.

The avocado does not soften on the tree, and in many varieties external indications of maturity are hardly perceptible. The correct stage at which to harvest is thus difficult to define, particularly in the green varieties. Usually a slight change in colour occurs on the skin and stem as the fruit approaches maturity. The gloss on the skin is not quite so pronounced and a yellowish tinge is perceptible on both skin and stem. Mature fruit ripens without any crinkling of the skin.

All fruits should be clipped from the tree and double cut so as to ensure that the stem is cut flush with the fruit. Pulling the fruit should be avoided, as damage to the button usually occurs and facilitates the entry of decay organisms.

CERTIFICATE COURSE IN AGRICULTURAL SCIENCE.

The Professor of Agriculture of the University of Queensland (Professor L. J. H. Teakle) advises that arrangements have been finalised for the commencement of this course on 1st February, 1950. The Certificate Course in Agricultural Science is being conducted by the University of Queensland and the Department of Public Instruction and will cover a minimum of 4 years. It is available to persons interested in agriculture.

All correspondence in respect of this course should be addressed to The Supervisor, Technical Correspondence School, Box No. 1389 R, G.P.O., Brisbane.

Cooling Milk on the Darling Downs by a Water-cooling Tower.

P. McCALLUM, Division of Dairying.

CLEANLINESS in all operations is essential for the production of milk of good keeping quality. However, even in cleanly produced milk bacteria will multiply rapidly and affect its keeping quality if it is not kept at a low temperature. The cooling of milk may therefore be regarded as a necessary step in its efficient production.

Table 1 illustrates the influence of temperature on bacterial growth in milk.

TABLE 1.

EFFECT OF TEMPERATURE ON BACTERIA IN MILK.

Milk immediately after milking	1,480 bacteria per ml.
Same milk, after standing 18 hours—	
At 48° F.	2,100 bacteria per ml.
At 54° F.	5,600 bacteria per ml.
At 59° F.	156,000 bacteria per ml.
At 64° F.	550,000 bacteria per ml.
At 70° F.	6,750,000 bacteria per ml.

Methods of Cooling.

Many methods of cooling milk on the farm have been tried over the years. They are:—

1. *Refrigeration.* This is the ideal medium, but requires a costly plant often beyond the means of many farmers.
2. *Water Cooling.* Devices which use water to effect a cooling of milk may be subdivided into—
   (*a*) Tubular coolers, in which the water used is pumped from an underground concrete pit or tank, or is gravity-fed from a windmill or other tank.
   (*b*) Water-cooling tower systems.

3. *Aeration.* This method affects only a very limited degree of cooling under Queensland conditions because of the high atmospheric temperatures. Aeration may be effected by the following means—
   (*a*) Blower-type coolers, in which a mechanical fan blows a strong current of air into the milk as it enters an enclosed drum, causing it to be broken up into a fine mist.
   (*b*) Fan coolers, whereby a car fan is used to blow a current of air into the milk as it passes over an aerator.
   (*c*) Aerators of the drop-cooling principle, whereby cooling is effected by running the milk over a series of metal plates or dishes set one below the other.

It is not the purpose of this paper to give details of the various types of coolers, but to record some observations made on the cooling of milk by a water-cooling tower system used on a farm in the Pittsworth district on the Darling Downs.

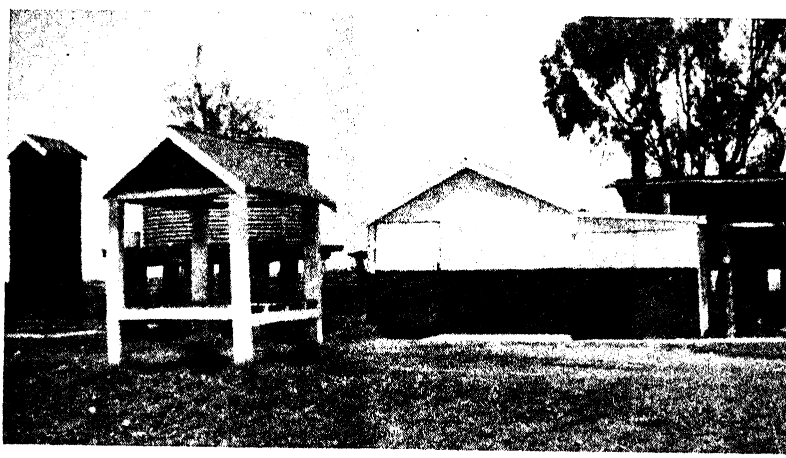


Plate 29.
WATER-COOLING TOWER.—Showing Position of Tower (left) to Milking Bails and Milk Stand.

The Water-Cooling Tower.

The advantages of the cooling tower are well known around Brisbane and Beaudesert, where milk is produced for the Brisbane liquid milk trade. The Darling Downs, with its dry atmosphere, is well suited for this type of cooling system. With the object of testing this system on the Darling Downs, where a large quantity of liquid milk, and most of the milk for cheese-making in Queensland, is produced, Mr. H. R. Trott, of Yarranlea, created the first tower cooler (Plates 29 and 30) on the Downs.

This cooler has now been in operation for over 12 months and has given satisfactory results. Observations were carried out regularly each month to ascertain the degree of cooling practicable, and methylene blue tests carried out regularly at the Yarranlea cheese factory have also shown that first quality milk is produced consistently, even under hot summer conditions, from the farm on which the cooler is installed.

With the water-cooling tower system, the water is pumped from a cement pit (1 ft. deep) at the bottom of the tower, through a tubular milk cooler, and then to the top of a 12 ft. wooden tower, where it enters a tray and showers down over a series of baffles to the pit at the bottom of the tower, to be recirculated again. By this means the cooling water is cooled down to the wet-bulb temperature, which is usually much lower than the dry-bulb reading of the thermometer. Tests carried out on the Downs have shown that the temperature difference between the wet

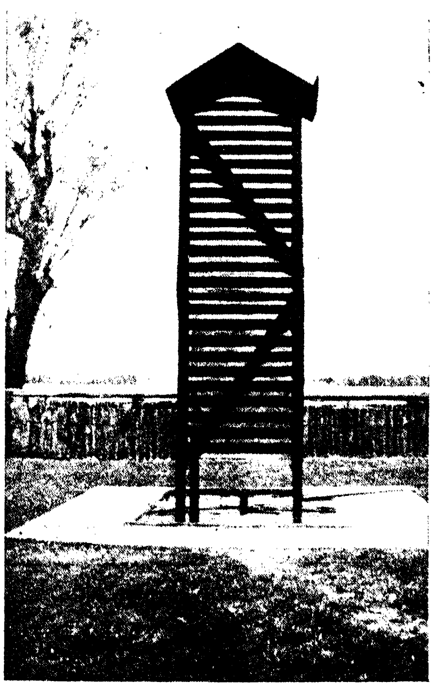


Plate 30.

CLOSE VIEW OF WATER-COOLING TOWER.

and dry bulb readings at 5 p.m. during the summer is usually from 10 to 20 degrees Fahrenheit. The wet-bulb thermometer is simply an ordinary thermometer, the tip of which is covered with cloth kept saturated by a small glass of water in which it is suspended. When the atmosphere is dry the water on the wet bulb thermometer evaporates rapidly, causing a cooling effect, so that the wet-bulb thermometer reads lower than the one with the dry bulb. The greater the difference between the two thermometers, the drier the air and the greater the cooling effect. If the air is saturated with moisture, there will be no evaporation from the wet bulb and the two instruments will read alike.

Table 2 sets out some comparative results obtained by checking various cooling systems on some farms in the Pittsworth district.

TABLE 2.

Date.	Type of Cooler.	Wet Bulb Temperature. °F.		Temperature of Milk in Can. °F.	Deviation from Wet Bulb Temperature °F.
24th September	Mechanical blower ..	a.m.	61	73	12
		p.m.	58	72	14
	Water-cooling tower ..	a.m.	61	63	2
		p.m.	60	64	4
25th September	Underground cement pit	a.m.	48	65	17
		p.m.	56	68	12
	Water-cooling tower ..	a.m.	48	51	3
		p.m.	58	62	4
30th November	Water from windmill tank	a.m.	62	81	19
		p.m.	60	82	22
	Water-cooling tower ..	a.m.	62	66	4
		p.m.	60	64	4
2nd December	Fan driven from engine ..	a.m.	..	..	..
		p.m.	66	81	15
	Water-cooling tower ..	a.m.	..	..	..
		p.m.	65	68	3

The above figures show that on an average it is possible to cool the milk from 10° to 15° lower by the water-cooling tower system than by other systems now in general use. The beneficial effect that 10 degrees would have in keeping down bacterial development will be evident from a perusal of Table 1.

Other results obtained with the tower cooler during the summer months are given in Table 3.

TABLE 3.

Date.	Wet Bulb Temperature. °F.		Temperature of Milk in Can. °F.	Average Deviation from Wet Bulb. °F.	Cooling Range of Milk. °F.
10th January	p.m.	69	74	5	20
11th January	a.m.	64	66	2	28
21st January	a.m.	64	68	4	25
	p.m.	79	74	5	20
5th February	a.m.	62	66	4	25
	p.m.	65	72	7	20
10th March	p.m.	74	77	3	16
11th March	a.m.	70	72	2	20
14th March	p.m.	72	76	4	18
15th March	a.m.	68	72	4	..

Details of the construction of a water-cooling tower for cooling farm milk supplies are given in a Departmental leaflet. Where the farmer can erect the tower himself the cost is not very great. All hardwood sawn timber was used in this case and cost about £8; cement cost £2 10s.

ANIMAL HEALTH

Swine Brucellosis.

A. K. SUTHERLAND, Senior Veterinary Pathologist, Animal Health Station, Yeerongpilly.

Definition.

Swine brucellosis is a chronic infectious disease of swine which affects particularly the reproductive organs and causes infertility in both sexes. It is caused by a specific bacterium, *Brucella suis.*

History.

The disease was first described in Hungary in 1909, but precise knowledge of it dates from 1914, when Traum, in California, identified and studied the cause. The disease was referred to for some years as Traum's disease, and later as infectious abortion of swine, but the name swine brucellosis is now almost universally used by both farmers and scientists.

Brucellosis occurs in swine throughout Europe but it is apparently absent from Great Britain. It is of special interest to note that the disease spread into Denmark in the 1920's, but, as a result of determined efforts by farmers and veterinarians, it was completely eradicated from that country by 1932. It is quite common in the United States, particularly in the middle western States, which have a heavy and dense swine population.

Although swine brucellosis had probably been present in Australia for many years, it was first identified in 1932 by R. O. C. King at the Veterinary Research Station, Glenfield, New South Wales.

In Queensland, the first diagnosis was made in 1936 when a number of blood samples submitted to the Animal Health Station at Yeerongpilly gave positive reactions to the agglutination test. In recent years *Br. suis* has been isolated from pigs in this State. The numbers of blood samples tested for swine brucellosis at Yeerongpilly in the last few years are as follows:—

Year ended 30th June, 1943	450
Year ended 30th June, 1947	1,367
Year ended 30th June, 1948	1,610
Year ended 30th June, 1949	1,107

In the past 3 years all the breeding stock in 65 separate herds have been tested. Of these 65 herds, 21 (or 32 per cent.) were found infected and 44 (or 68 per cent.) showed no infection. Of the 34 herds which have been tested more or less regularly during the last 3 years, 28 herds (or 82 per cent.) are clean and only 6 herds are still infected. The disease is present in all the major swine raising areas of the State.

Economic Importance.

Although some pig producers have claimed that the presence of brucellosis is of no importance to the financial return from their herds, it is a disease which farmers cannot afford to neglect. It may be true that in some infected herds the financial loss is not great. On the other hand, in a great many herds brucellosis has rendered profitable production impossible. Careful records of infected herds in U.S.A. showed only 4.5 pigs weaned per sow bred, and there is no reason to believe that the disease behaves differently in Australia.

The causes of sterility in swine have been the subject of very little investigation, but the few studies that have been made in the United States have shown that the commonest cause of sterility in sows and boars is brucellosis.

No survey of the causes of infertility and sterility in swine in Australia has been reported. It seems probable, however, that in Queensland infertility, sterility, and birth of weak or dead pigs are most frequently due to either malnutrition or brucellosis.

Br. suis is important also because it may infect human beings, the disease being referred to as undulant fever. It often runs a chronic course, which may be fatal. Few human infections have been reported in Australia, but it is probable that many undiagnosed cases occur. It is seen most frequently in farmers and veterinarians through their contact with infected pigs and cattle. Since the swine organism, *Br. suis*, is more dangerous to man than the bovine organism, *Br. abortus*, the eradication of brucellosis from his pigs is the most important step that a farmer can take to reduce the risk of contracting undulant fever.

The Causal Organism.

Br. suis is related to, but distinct from, the organism *Br. abortus* which causes bovine brucellosis or contagious abortion of cattle. It is important to note that—

(1) *Br. suis* is found mainly in swine, but it does infect man and on rare occasions cattle; whereas

(2) *Br. abortus* is found mainly in cattle, and occasionally in man, and rarely in naturally infected swine.

Br. suis does not grow or multiply outside the body of an infected animal, but it will survive in moist, shaded situations about pens and yards for 2 to 3 months. In clean, dry yards the organism is probably quickly destroyed, especially if exposed to sunlight.

How do Pigs Contract Brucellosis?

Infected pigs may excrete *Br. suis* in urine, dung, milk, semen, or in the fluids and membranes expelled from the womb at farrowing. The infection is then carried from these materials to susceptible pigs, either by direct contact or indirectly on such things as boots, clothing, shovels, buckets, brooms, &c.

Infection is, however, contracted most often by service from an infected boar. Conversely, a clean boar may contract brucellosis by serving an infected sow. Besides service, infection can be contracted by swallowing contaminated food or water, or through contamination

of the eye or cuts or wounds on the skin. The organism is excreted in the urine for long periods and this is one of the important sources of infectious material. Uncooked offal fed to swine is also a source of infection.

Suckers quite often contract infection from their dams, either through contact or through drinking the infected sow's milk. Many animals which contract the disease as suckers or weaners throw off the infection, but a few will continue to harbour infection through to adult life.

Effect of Brucellosis on the Animal.

Once a pig has contracted infection the organism circulates in the blood for some days or weeks and then may localise in almost any part of the body—the lymph nodes, liver, spleen, bladder, udder, bones, joints, or the reproductive organs of either sex. Quite often an infected animal appears healthy, and the presence of the disease becomes evident only when the breeding record is studied carefully.

The symptoms of brucellosis may be summarised as follows:—

(1) In boars, a swollen testicle is the symptom most often observed, but quite often the infection is confined to sexual organs within the body (prostate, seminal vesicles, bulbo-urethral glands) so that no abnormalities are visible externally. When brucellosis becomes established in a boar it usually results eventually in sterility.

(2) In sows, brucellosis in the womb causes infertility, which may be either temporary or permanent. All or part of the litters produced by infected sows may be born dead or they may be weak and die a few days after birth. The disease also causes abortion, which often occurs 3 to 4 weeks after mating and so frequently escapes attention because the sow is apt to eat the afterbirth and the aborted piglets. Sows may suffer only temporary infertility and thereafter breed normally, or they may abort once or twice and then carry succeeding litters to full term. In other sows, however, infection may persist indefinitely in the womb, causing sterility.

(3) When the organism localises in the bones or the joints it usually persists there for years and causes swollen joints, lameness, or paralysis.

Diagnosis.

Neither the symptoms nor the post-mortem findings are sufficiently characteristic to enable one to make a definite diagnosis. Infertility, abortion, stillbirths, swollen joints, and lameness are often due to other diseases (such as malnutrition, paratyphoid, erysipelas, or tuberculosis), hence we have to rely on laboratory tests for exact diagnosis.

The Agglutination Test.

This test is done at the laboratory on blood serum samples. The test is based on the fact that in the serum of infected animals there are substances, called agglutinins, which act on a watery suspension of Brucella bacteria in such a way that the bacteria clump together (that is, agglutinate). Thus, the test is done by mixing together in small

glass test tubes accurately measured amounts of serum and a standard suspension of Brucella bacteria. The tubes are placed in an incubator at 37 deg. Cent. for 48 hours and then examined. When a *small* quantity of serum causes visible clumping of the bacterial suspension, then the serum is said to have a high titre and it is classed positive to the test. When even a large amount of serum has no action on the bacteria, then the serum is said to have a low titre and it is classed negative to the test (see Plate 31). Serums whose titres are in between the low titre (negative) and the high titre (positive) are called suspicious.

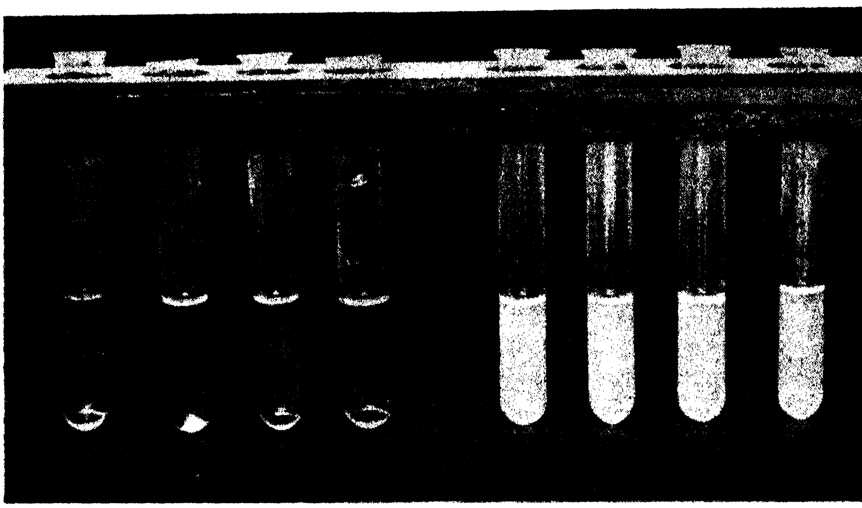


Plate 31.

AGGLUTINATION TEST FOR BRUCELLOSIS.—Four tubes are set up for each serum to be tested. The four left-hand tubes show a positive reaction—the bacteria have been agglutinated and settled to the bottom of the fluid. In the negative reaction on the right, the serum has had no action on the milky bacterial suspension.

Although the agglutination test for swine brucellosis is not as efficient as some other laboratory diagnostic tests (for example, the agglutination test for bovine brucellosis), it is the only practicable test available. It has been frequently criticised but, provided its shortcomings are realised, it can be profitably used for controlling brucellosis. The facts regarding the agglutination test for swine brucellosis have become clear as the result of intensive studies in several laboratories in U.S.A. in only the last few years. These facts are summarised as follows:—

(1) A few weeks after a pig contracts brucellosis, its blood gives a positive reaction to the test. Most animals continue to give a positive blood reaction as long as they have infection in their bodies, but in some animals the blood reaction becomes weaker so that they become suspicious and later even negative to the test, notwithstanding that they are still infected. Unfortunately, some infected animals give a positive reaction for only a short period (weeks or months) after they contract the disease.

(2) The animal that gives a suspicious reaction may be either—

(*a*) An infected animal whose blood reaction is on the increase from negative toward positive as a result of recent infection (a few weeks later such an animal would be positive); or

(*b*) An infected animal whose blood reaction is on the way down from positive toward negative; or

(*c*) An animal which is not in any way infected with brucellosis.

(3) Therefore, a negative reaction in an animal in an infected herd is not definite evidence of freedom from brucellosis, because—

(*a*) The animal may have been only recently infected so that its blood had not had time to develop a positive reaction; or

(*b*) The animal may have previously been positive and then come back to negative although still infected.

On these facts are based certain guiding principles for using the agglutination test in the control of swine brucellosis. To establish whether a herd is infected, all the breeding pigs should be tested.

Plate 32.

COLLECTING A BLOOD SAMPLE FROM THE TAIL.

When a whole herd is negative to the test, the breeding history is normal and there have been no recent introductions, then the herd can be regarded as clean. Repeat tests at prescribed intervals would, of course, be necessary for certification as a brucellosis-free herd. In a herd with a normal breeding record and no recent introductions and no positive reactors, the presence of a few suspicious reactors is not regarded as evidence of brucellosis.

In an infected herd a negative reaction in individual pigs does not indicate freedom from infection. In *any* herd a positive reaction is definite evidence of infection.

Plate 33.
AN IOWA HOG-HOLDER MADE FROM 5/8 INCH STEEL PIPE 24 INCHES LONG AND A 3/16-INCH WIRE CABLE.

Collecting Blood Samples for the Agglutination Test.

Blood samples for the agglutination test may be taken from the veins of the ear or the tail or from the great vein (anterior vena cava) at the base of the neck.

To collect samples from the ear vein the pig must be restrained in a race or small pen and then secured by means of a noose over the upper jaw tied to a post. The edge of the ear is cleaned with methylated spirits and then dried. A large vein near the edge of the ear is then cut across with a sharp knife. The blood which flows slowly from the cut vessel is then collected in a 1-oz. bottle as it drops from the outer margin of the ear.

Plate 34.
COLLECTING A BLOOD SAMPLE FROM THE ANTERIOR VENA CAVA.

The technique for collecting blood from the tail is shown in Plate 32 A knife with a rather sharp point is used to make a stab about ¼-inch deep exactly in the mid-line on the under surface of the tail about 1 inch from its root. For this operation the pig may be held in a crate or race, or he may be caught and held in a small pen by means of an "Iowa hog holder" (Plate 33) over the upper jaw. Another method which is quite useful when other means of restraint are not available is to withhold the morning feed and then offer a small feed at the desired time so that the tail can be cut and the blood collected while the pig feeds greedily at a trough.

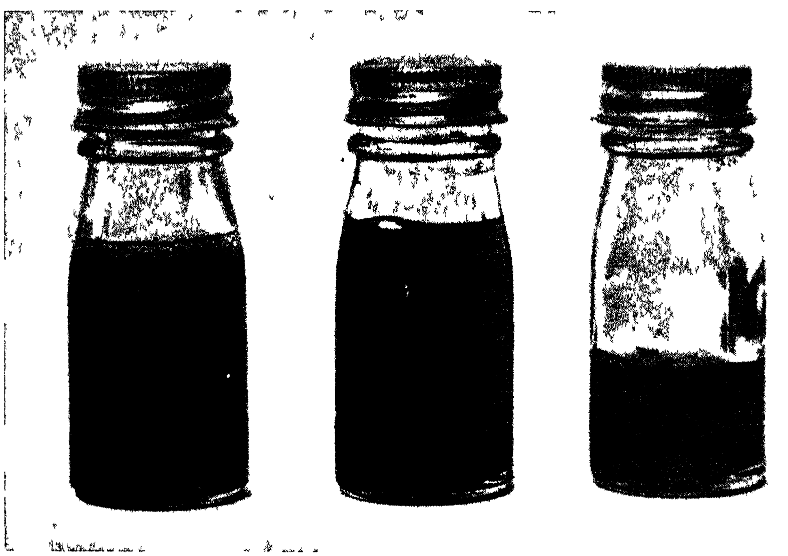


Plate 35.
Left.—Blood sample before clotting Centre—Blood sample with clear serum separated from clot; Right—Serum sample.

The technique of collecting blood from the anterior vena cava by means of a syringe, shown in Plate 34, is now widely used by veterinarians in U.S.A. The pigs are placed in a small yard and then caught and held with an Iowa hog holder Small pigs are easier to bleed if they are held by hand on their backs in a V-shaped trough This technique requires more practice than ear or tail bleeding, but once the technique is learned it is the quickest and best method and it has the great advantage that it yields better and cleaner samples for testing. It is, however, essential to use the proper syringe needle according to the size of the pig for this technique.

Whatever method is used, about ½-oz blood is collected in an absolutely clean, dry bottle. After the samples have clotted (about 30 minutes) they are taken to an office or other suitable place to allow them to stand undisturbed for several hours. At this stage clear serum should have separated from the blood clot (Plate 35) and the serum can be poured or pipetted into another clean, dry bottle. The serum must be poured carefully to avoid including the red colouring matter from the blood. For best results the work should be arranged so that the

pigs are bled in the morning and the serum poured off late on the same afternoon. The serum samples are then sent with all haste to the Animal Health Station at Yeerongpilly or at Oonoonba. If the samples can reach the laboratory on the same day that they are collected, then the whole blood sample may be submitted instead of the serum only. However, if whole blood samples are delayed reaching the laboratory these are very likely to be unfit for testing.

It is, of course, necessary to label every sample carefully so that it is accurately identified with the pig from which it was taken.

The Control of Brucellosis.

No effective treatment for brucellosis is known nor has any effective method of vaccinating swine to immunise them against the disease yet been discovered.

Ten years ago it was often said that brucellosis among swine was a self-limiting disease and, therefore, no action to control it was necessary. It is true that some sows (but very few boars) tend to throw off the infection, so that in a small herd with a rapid replacement of the breeders and a high standard of sanitation the disease might die out. Experience has shown, however, that it is unwise and unsafe to rely on nature to deal with the disease in this way.

When non-purebred herds are found infected the best plan is probably to fatten and sell the whole herd for slaughter and then replace with new, young stock from a certified brucellosis-free herd. The premises should be cleaned and disinfected and the pastures and yards should be spelled to allow infection to die out before restocking.

The procedure recommended for eradicating brucellosis from infected purebred herds is a combination of quarantine, sanitation, and blood testing. The steps in this procedure are outlined as follows:—

(1) All breeding sows and boars are tested.

(2) Weaners are selected from negative sows with a normal breeding record and isolated at eight weeks of age on clean ground. Thereafter, these young stock are kept in strict isolation. They are tested immediately before weaning, then several times up to breeding age, and particularly immediately before mating and during pregnancy. Any animals found positive are immediately culled from the isolated clean unit. By this procedure it is possible to replace an infected herd by a brucellosis-free herd in a year or so.

(3) The whole of the old herd of breeders (negatives as well as positives) is sold for slaughter as soon as they are marketable, because there is always a risk that infection may be carried from them back to young stock being reared in isolation as disease-free replacements.

(4) If it is particularly desired to conserve the progeny of a positive sow, then her litter may be weaned at eight weeks and isolated and tested as already described. However, there is some risk in doing this because a small percentage (roughly 10 per cent.) of animals infected as suckers remain infected up to their first farrowing and, in the case of boars, sometimes throughout their lives.

Disinfection.

The selection of premises for rearing the clean replacement herd requires careful consideration. Clean pasture away from and receiving no drainage from infected premises is the ideal. If pens or houses previously occupied by infected stock are used they must be thoroughly cleaned and exposed to sunlight, and left vacant for two months. Chemical disinfectants (for example, 5 per cent. lysol) may be used where they are applicable, as in concrete pens.

Care of Clean Replacement Herd.

Certain precautions are necessary to prevent infection being introduced into the clean replacement herd of young stock. It is desirable that they should be cared for by separate persons, but if this is not practicable, then they should be attended first before the remainder of the herd. Rubber boots should be worn and disinfected to avoid spreading infection

The clean replacement unit should be provided with new troughs and equipment; or, if previously used materials are used, they must be thoroughly cleaned and disinfected beforehand.

Protecting Brucellosis-free Herds.

To prevent infection being introduced into a clean herd, or when assembling a new herd, certain important points should be noted. Pigs should be bought, if at all possible, from certified brucellosis-free herds only. Animals from infected herds or herds of unknown status are always a danger even if they are negative to the agglutination test. If it is particularly desired to purchase pigs from herds which are not certified, then they should be held in isolation and tested several times at monthly intervals before being allowed to mingle with the herd, although even this procedure is not certain to prevent introduction of a diseased animal. Pigs exhibited at shows may also introduce infection unless proper precautions are taken.

The practice of lending boars or accepting sows for service is also dangerous.

Care should be taken against introducing infection through either equipment or boots or clothing which has had contact with an infected herd.

Summary.

(1) Brucellosis is a serious infectious disease of swine because of its effects on the fertility of both boars and sows.

(2) Infected pigs may transmit the disease to human beings having contact with them, causing human brucellosis (undulant fever).

(3) The symptoms and post-mortem findings are not characteristic, so that laboratory tests are necessary for an exact diagnosis.

(4) The only practicable test available for use on large numbers of animals is the agglutination test, which is done at the Animal Health Stations on samples of blood serum.

(5) The agglutination test for swine brucellosis is not highly efficient for diagnosis but its shortcomings are now much better understood as a result of extensive studies completed in only the last few years.

(6) Notwithstanding its deficiencies, the agglutination test has proved effective in eradicating the disease from many herds in this State and in other parts of the world.

(7) To eradicate brucellosis from an infected herd, attention should be concentrated upon replacing *all* the older breeding stock with young stock which have been weaned at eight weeks of age from sows negative to the agglutination test. The young replacement herd should be reared in strict isolation and tested several times so that any infection among them may be promptly detected.

(8) The purebred herds of Queensland are at present not heavily infected. It is therefore considered that because of the effect of brucellosis on the efficiency of production, and because of its public health importance, eradication by blood testing and segregation should be pursued (in spite of possible difficulties), otherwise the disease may get out of hand, as it has done in some parts of the world.

Vibrionic Abortion in Cattle.

G. C. SIMMONS, Assistant Bacteriologist, Animal Health Station, Yeerongpilly.

Introduction.

A NUMBER of species of microorganisms has been incriminated as the cause of infectious abortion in cattle, the most important being *Brucella abortus,* which causes brucellosis. However, two other organisms—*Trichomonas foetus* and *Vibrio fetus*—can cause considerable economic loss by causing abortion and sterility in infected animals.

Recently, abortion due to *V. fetus* infection was diagnosed in three herds in Queensland, two in the Brisbane division and one on the Darling Downs. These cases were brought to the notice of Departmental officers by farmers who had abortions occurring in cattle which had been vaccinated with *Br. abortus* Strain 19 vaccine. Inoculation of calves with this vaccine has proved very successful in increasing the animals' resistance to brucellosis and greatly reducing losses from abortion and sterility. It is known, however, that vaccinated cattle may succumb to brucellosis by exposure to large doses of virulent strains of *Br. abortus.* On the other hand, when vaccinated animals abort it should be remembered that microorganisms other than Brucella may be responsible.

Economic Importance.

Vibrionic abortion has been diagnosed in most parts of the world in both sheep and cattle. As a cause of abortion and sterility in cattle, vibrionic infection is less important than brucellosis or trichomoniasis. Usually only single sporadic cases occur. However, in infected herds studied in America, up to 20 per cent. of cows mated have aborted because of this disease.

It has also been suggested that udder development is retarded in cows which abort.

Cause.

Vibrionic abortion is caused by infection with a bacterium named *Vibrio fetus.* The organism is not very resistant and rapidly dies outside of the animal body.

Mode of Infection.

Cows are probably infected by coming into contact with the "slink" (aborted calf) or the fluids and membranes expelled by infected cows. They may also be infected by service from an infected bull.

Symptoms.

The most obvious sign of this disease is the failure of cows to carry the calf to full term, the calf being aborted at any time 2-8 months after mating. If the abortion occurs early in the gestation it may not be noticed and the cow will return to the bull again.

In many cases the after-birth is retained and a discharge may occur from the womb.

In both cows and bulls no obvious sign of ill-health is produced.

Diagnosis.

This disease can be diagnosed with certainty only by bacteriological examination of the foetus. It is therefore advisable for farmers to contact officers of the Department of Agriculture and Stock or a practising veterinary surgeon if abortions are occurring, so that suitable arrangements can be made to forward a freshly aborted foetus, or specimens from one, to the laboratory for examination.

Treatment and Control.

No treatment is available for this disease.

The disease in many herds tends to be self-limiting—that is, after causing a number of abortions, which may be few, or as high as 20 per cent., the disease of its own accord dies out.

Control steps, applicable not only to vibrionic abortion but to any other type of infectious abortion, are—

(1.) A Departmental officer or a practising veterinary surgeon should be consulted so that the type of abortion can be determined.

(2.) If abortions are occurring, the cows should be watched closely so that those showing signs of impending abortion may be promptly isolated.

(3) The aborted calf and the membranes should be located as soon as possible so that they may be promptly burned or buried deeply under lime to prevent spread of infection.

(4.) The cow should be held in isolation and not bred until all discharge from the womb has ceased

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 1st DECEMBER, 1949).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas.

The Young Farmer.

MONTO FIELD DAY.

THE Monto Q.D.O. and Junior Farmers' Club members staged a most successful field day on the Monto Showgrounds on Thursday, 1st December, when officers of the Department of Agriculture and Stock carried out a number of demonstrations and addressed those present on various aspects of farm and dairy work. The attendance numbered nearly 50 persons.

Mr. B. Ostwald, President of the Q.D.O. Branch, presided and welcomed the visitors and local residents. He stressed the importance of such days and the value to young and old of the demonstrations and lectures which had been arranged for their benefit.

Visitors included Mr. T. L. Williams (State Director, Junior Farmers' Organisation), Mr. M. L. Cameron (General Manager of the Agricultural Bank), and Mr. C. Sewell (Local Inspector of the Bank).

Lunch and afternoon tea were provided by a band of willing workers headed by Mrs. Bartlam, wife of the district Dairy Adviser, Mr. R. H. Bartlam, who with other local officers of the Department of Agriculture and Stock was responsible for the arrangements.

New Clubs.

Three new Junior Farmers' Clubs—Chinchilla, Warra, and Brigalow—were formed early in December after meetings of local farmers and their sons and daughters had been addressed by the State Director of the organisation.

Officials elected for the respective clubs were as follows:—

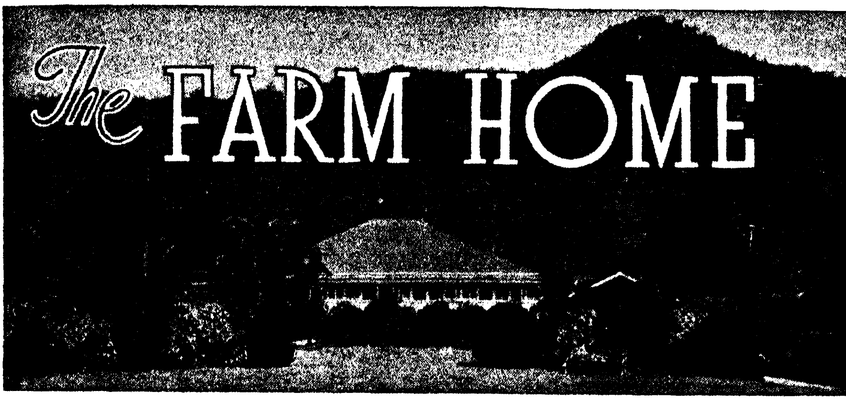
Chinchilla—Club leader, George Powell; deputy-leader, Albert Valler; secretary-treasurer, W. Mann; advisory committee, Messrs. Roy Evans, J. Gormley, T. W. Crawley, and J. Hinds (Dairy Adviser, Chinchilla).

Warra—Club leader, P. Wright; deputy-leader, Neville Taylor; secretary, Brian Moore; treasurer, Cliff Parsons. An advisory committee to assist the club in its various activities is to be elected during the club's first meeting in January.

Brigalow—Club leader, Harley Fisher; deputy-leader, Norman Stewart; secretary-treasurer, John Beutel; advisory committee, Messrs. W. Beutel, T. T. Schloss, W. Woolley, and J. Hinds.

Appointment of Assistant Organiser.

Owing to the growth of the Junior Farmers' Organisation in Queensland, the State Government recently approved of the appointment of an Assistant State Organiser to assist Mr. Williams in his work. Mr. C. V. Lilley, Stock Inspector in the Department of Agriculture and Stock, has been selected for the position and will commence duties in February.



Problem Children.

HAVE you a so-called problem child in the family? One who worries you to distraction because he won't eat, won't sleep, won't move his bowels at the appropriate time, or is subject to temper tantrums, and other behaviour problems? In fact, a child who has an uncontrollable tendency to do what he ought not to do and to leave undone what he ought to do, with the result that there is no health left in him? This attitude of mind is described in scientific circles as "negativism" but to the ordinary parent it is probably better known as "cussedness" or "contrariness."

Now, before losing patience with the child or arriving at the brink of a nervous breakdown, it is wise to review the situation placidly and calmly and above all with a broad and enlightened mind. For, more often than not, the fault does not lie with the child but with its parents and guardians. But, having lavished all the care and attention at your disposal upon your particular problem child, you may deny this with some feeling. However, if you still remain calm and unbiassed you may have diagnosed the flaw in your parentcraft, for too much care and attention may do as much harm as too little.

The Only Child.

The majority of these children are either "solitary children" or children who come from broken homes and are deprived of a normal happy family life.

It is with the solitary problem child that this article is mainly concerned.

The solitary child is not necessarily an only child, although his troubles are so characteristic as to lead to the stock label of "only-childism." Any child who is brought up alone amongst grown up people may suffer from it. Others of course are so happily constituted by nature, or are so fortunate in the character of their parents, that they escape the disorder altogether.

Let us consider for a moment the peculiarities of the environment of the solitary child. A child so situated is constantly associating with grown up people and so fails to learn the salutary lessons of give and take or social adaptation imposed upon more fortunate children by

their brothers and sisters or playmates. It becomes a misfit in an essentially adult society, which leads, on the mental side, to the development of precocity and what is termed "old fashionedness" and on the physical side to nervous strain with all its concomitants. The value of Kindergartens in such situations should be obvious. Almost inevitably, too, the solitary child has too much attention paid to it. It is apt to get to feel that it is the most important person in the house, and the pivot around which the whole domestic world revolves. It thus acquires a liking for being in the limelight and the centre of the stage, and will resort to any devices, some quite abnormal, rather than allow itself to be thrown even for a moment into the shade.

Further, as the parents or guardians of the solitary child have all their eggs in one basket, they naturally enough tend to fuss over the basket to an undue degree. There results from this an extreme anxiety about the child's health. Every little ailment is magnified, and the resulting atmosphere of apprehension is communicated to the child itself. Matters are made worse by the habit, so frequent with such parents, of discussing the child's health in his presence, with the result that he becomes in time, a veritable little hypochondriac.

All this however does not necessarily imply that the "only" child is at the same time a "spoilt" child. The mother will often, and rightly, repudiate with indignation that her child is spoilt. But if the child is not over-indulged he is at least over-studied and pampered. As a matter of fact, the mother of the only child is often over-conscientious in the discharge of her maternal duties but lacks a sense of humour and proportion. As well as pampering the child physically, mentally and emotionally, she also makes her child's "moral being" her main care, and is for ever correcting, exhorting and forbidding. The result is that she induces in the child what plain people term "cussedness" but what it is now the fashion to speak of as "negativism." It is this mental condition which is the explanation of the refusal to eat, the refusal to sleep, and all the other "refusals" which are characteristic of the solitary child.

You will see, then, that only-childism is a complex condition, made up of physical, mental and moral ingredients. Physically, the child who suffers from it is thin, restless and nervous. He eats, digests, and sleeps badly and tires easily. Mentally he is excitable, emotional, precocious, introspective and hypochondriacal. Morally he is disobedient, troublesome and often ill-tempered and "impossible."

If after calm consideration you cannot find any flaws in your parentcraft, it would be wise to take your problem child to a doctor and enlist his help in getting to the root of the trouble.

Is Your Child Ill?

A child who is naughty may merely be suffering from lack of sufficient sleep, from malnutrition (which means improper feeding as well as underfeeding), from teething or ear troubles, or from some more serious illness. If you are worried on this score, call in your doctor and he will resolve your problem for you. If no doctor is available, endeavour to obtain advice from your nearest Clinic or some qualified person. Do not listen to alarmist advice given gratuitously by neighbours, relatives, or in-laws.

Is the Child Worrying?

If the child is obviously not ill, has he got some hidden problem or anxiety of his own? Is he worrying over the loss or illness of a beloved relative, friend or toy, or some other matter? If he is, reassure him and comfort him.

Is he suffering from a sense of insecurity or unwantedness brought about by family disharmony or a broken home? Parents forget how impressionable children are and what a devastating effect family quarrels, or any situation where the normal father-mother-and-children sort of relationship is missing, may have on a sensitive child. It is no coincidence that such a high proportion of delinquent and neurotic children come from such unsatisfactory homes as these.

Maybe he is merely jealous of a new addition to the family. He may not show it openly—in fact he may be most loving and affectionate—but subconsciously he may strongly resent the usurption of his usual place in the family by the new arrival. He may compete with the baby in every way, even to the extent of reverting to infantile habits and becoming wet and dirty again and refusing to take his milk except from a bottle, &c. It is now generally recognized that this emotional upset can become the cause of various disturbances, such as difficulties of sleeping and feeding, bed wetting, temper tantrums, and other behaviour problems. But these troubles will pass if he is treated wisely and justly. He should not be allowed to feel out in the cold—he should be taken into your confidence beforehand and told that you are going to present him with a new brother or sister, and when it arrives you should endeavour to give the older child the same amount of affection and attention as he has been used to before.

Is the Parental Attitude Right?

Having cleared up these points, it is now time to ask whether your attitude towards and general management of the child is correct or not. It must be remembered, of course, that every child is an individualist and requires to be respected as such. However, for the generality of children some general principles may be stated.

A child's education in the home consists primarily not of what is said to him, but in certain fundamental experiences.

The first essential condition to normal, healthy development within the home is *Affection and Security* and this can only come from parents who are in harmony with one another as well as with their offspring.

If a child receives normal affection from his parents he has a good start. He takes it for granted that he will receive affection in the world and is ready to respond with good feelings.

On the other hand, over-possessive, suffocating love can do considerable harm. The child's personality is choked by it and lacks freedom to grow. If the atmosphere surrounding him is too tense and emotional he is likely to prove a hothouse plant who cannot stand up to the storms of everyday life. "Love them and leave them alone" is a good maxim.

Secondly, it is in the home that the experience of *Law and Order* must begin; where the clamorous claims of small individualists must first be brought into proper adjustment to the needs of other members.

It is absolutely impossible to get along in this world without some rules and regulations, and children will for the most part obey reasonable rules in a reasonable manner. But complete laxity, harsh discipline or injustice may cause havoc to the developing mind of a child. What is essential is that the measures taken should be consistent, reasonable, and administered calmly and unemotionally on the part of the parents. There is no doubt that reasonable punishment has its uses, especially for minor faults, but for major faults what the child more often wants is help over some difficulty in life.

A correct balance must be struck between scope for self expression and necessary limits to freedom.

Foolish threats which frighten the child or too many "Don'ts" are most unwise and should never be resorted to; and, remember, never lose your temper when dealing with a child, for example is always better than precept.

Thirdly, the young child needs *Outlets* for his emotional, social and intellectual development. He should be given opportunities to create and construct, to experiment and to explore, to learn about things and people in his own way and in his own time. This is best accomplished by play. Ideally, children need some space that they can call their very own, where they can be about their own ploys, use messy materials such as sand, water and plasticine, and indulge their fertile imaginations in play-acting and such like activities.

As the child grows up, his measure of self reliance in facing the difficulties of life, and in attending to his own desires, should steadily increase. You must let him struggle with some difficulties, make some painful mistakes, destroy by foolishness some useful or valued article, for it is by such experience that mental growth is secured.

Furthermore, during these tender years a child should never be unnecessarily exposed to disparagement or to depreciation of his efforts or capabilities. So far as possible, failures and errors should be ignored. When the child is doing something he should be left to his own devices until he asks for help or obviously needs it; the child learns most effectively by his own struggles and errors, and from his own successes he gains confidence. While the failures should be ignored, the achievements should be praised and admired; encouragement here builds up the self-reliant and creative character.

Any further information on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's Terrace, Brisbane, or by addressing letters "Baby Clinic, Brisbane." These letters need not be stamped.

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ASTRONOMICAL DATA FOR QUEENSLAND.

FEBRUARY.

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Date.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5.21	6.42	Cairns	41	17	Longreach ..	40	30
6	5.24	6.40	Charleville	29	25	Quilpie	34	36
11	5.28	6.36	Cloncurry	57	42	Rockhampton ..	15	5
16	5.32	6.32	Cunnamulla ..	28	30	Roma	18	16
21	5.35	6.28	Dirranbandi ..	18	20	Townsville ..	34	16
26	5.38	6.23	Emerald	24	14	Winton	46	34
28	5.40	6.21	Hughenden ..	42	27	Warwick	3	5

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Date.	Rise.	Set.
	a.m.	a.m.
1	5.43	3.04
2	6.29	4.07
3	7.11	5.12
4	7.48	6.18
5	8.23	7.22
6	8.56	8.26
7	9.29	9.30
8	10.04	10.34
9	10.44	11.40
		p.m.
10	11.28	12.47
11	..	1.55
	a.m.	
12	12.19	3.00
13	1.16	4.01
14	2.18	4.54
15	3.22	5.40
16	4.25	6.19
17	5.26	6.52
18	6.24	7.22
19	7.19	7.50
20	8·12	8 18
21	9.04	8.45
22	9.58	9.15
23	10.52	9.47
24	11.47	10.23
	p.m.	
25	12.44	11.05
26	1.41	11.53
27	2.37	..
		a.m.
28	3.30	12.47

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4;

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	9	30	25	45	0	21	26	54
6	19	20	35	36	10	11	41	42
11	29	10	44	24	19	0	52	27
16	27	13	43	28	18	2	51	31
21	16	23	32	39	8	14	36	45
26	9	30	25	45	0	21	26	54
28	9	30	25	45	0	21	26	54

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	3	56	34	67	18	53	4	46
3	12	48	38	62	23	48	11	40
5	24	38	46	56	31	41	21	33
7	36	25	55	47	40	32	30	22
9	47	12	63	38	47	24	39	12
11	52	4	66	33	50	19	43	5
13	57	2	69	32	53	17	47	3
15	53	7	67	35	50	21	44	8
17	43	17	60	42	45	27	36	16
19	34	28	53	49	38	34	28	24
21	23	38	46	56	30	41	20	33
23	13	47	39	62	24	47	12	39
25	5	55	35	67	19	52	5	45
27	1	56	32	67	16	53	2	46
28	2	55	33	67	17	52	3	45

Phases of the Moon.—Full Moon, 3rd February, 8.16 a.m.; Last Quarter, 10th February, 4.32 a.m.; New Moon, 17th February, 8.53 a.m.; First Quarter, 25th February, 11.52 a.m.

On 15th February the Sun will rise and set 15 degrees south of true east and true west respectively, and on the 6th and 19th the Moon will rise and set at true east and true west respectively.

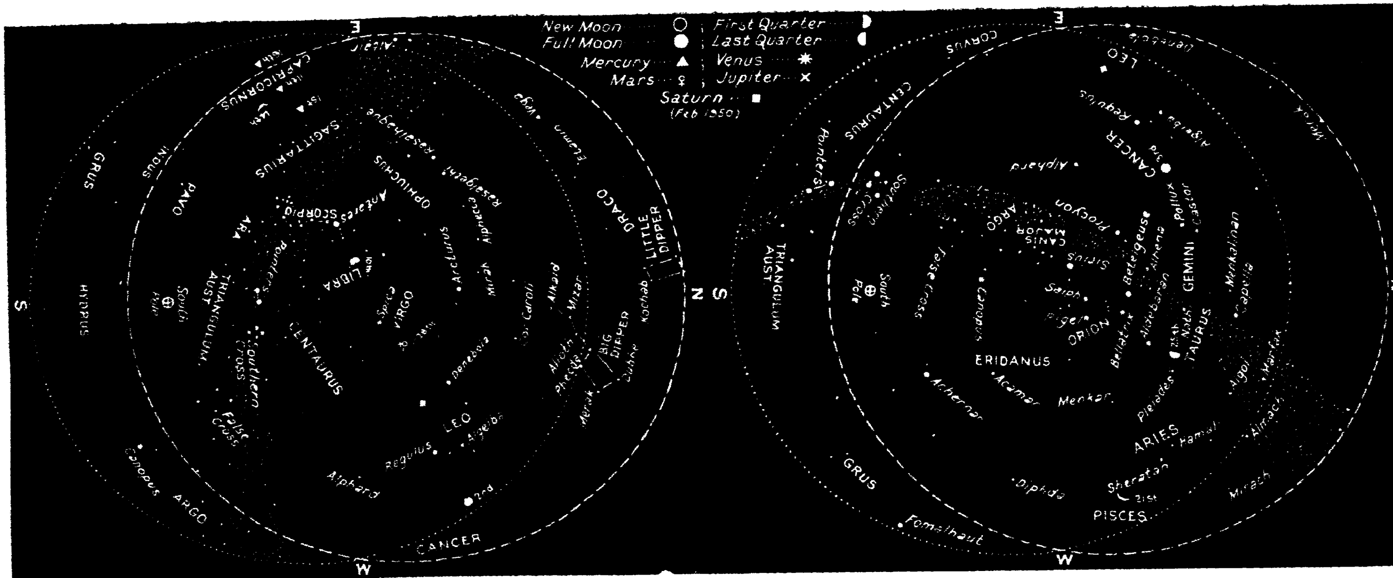
Mercury.—At the beginning of the month, in the constellation of Sagittarius, will rise 1½ hours before the Sun, and on the 10th, in the constellation of Capricornus, will reach its greatest angle west of the Sun, when it will rise 2 hours before sunrise. At the end of the month, still in the constellation of Capricornus, will rise 1½ hours before the Sun.

Venus.—Too close in line with the Sun for observation at the beginning of the month, but by the end of the month will rise 2½ hours before the Sun and will be conspicuous in the morning sky in the constellation of Capricornus. About the middle of the month Mercury will pass close to Venus.

Mars.—Now well placed for observation in the early part of the night, rising between 9.45 p.m. and 11 p.m. at the beginning of the month and between 7.45 p.m. and 10 p.m. at the end of the month.

Jupiter.—Not favourably placed for observation, this month being in conjunction with the Sun on the 3rd.

Saturn.—In the constellation of Leo, will rise between 8.30 p.m. and 9.45 p.m. at the beginning of February and between 6.45 p.m. and 8 p.m. at the end of the month.



Star Charts.—The chart on the right is for 8.15 p.m. in the south-east corner of Queensland to 9.15 p.m. along the Northern Territory border on the 15th February (for every degree of Longitude we go west the time increases by 4 minutes). The chart on the left is for 8 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing North hold "N" at the bottom; when facing South hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars, which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

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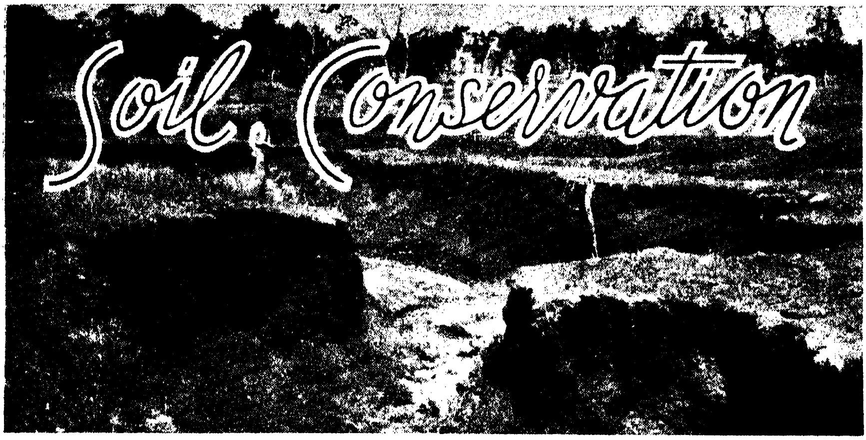
Contents



Soil Conservation in Queensland.

J. E. LADEWIG, Senior Soil Conservationist, and A. F. SKINNER, Soil Conservationist.

(*Continued from page 25 of January issue.*)

2. Soil Conservation.

Soil conservation simply means the correct use of land so that maximum permanent production is assured; all practices that assist in achieving this are soil conservation measures, but the primary object is the prevention and control of erosion.

The soil is commonly regarded as something permanent, to be treated in any manner which will suffice to produce a return by the most convenient and economical methods. Such a conception is erroneous and dangerous, because the soil, unless carefully managed, is no more permanent than buildings or machinery, which are obviously depreciating assets for which financial provision for both depreciation and repairs must be made. Soils cannot be expected to produce indefinitely under conditions which do not provide for the maintenance of their original structure and fertility. If even 1 per cent. per annum of the value of the land were spent on measures designed to retain the soil in its original condition, there would be only a minor erosion problem to-day. This same amount or more is expended on maintenance of machinery and is considered a legitimate charge. When the machinery becomes obsolete it can be replaced, but when soils have been exploited to the point of unproductivity, replacement is impossible. Unfortunately, exploitation is generally an extremely profitable business while the soil lasts, and until the individual farmer has suffered from soil exploitation he is usually unable to appreciate the benefits conferred by conservation farming.

Soil conservation, then, means much more than a series of contour banks across the land or ploughing on the contour. It includes all farming techniques the aim of which is the maintenance of fertility, physical structure, and the ability of the soil to absorb and retain rainfall; consequently, it embraces many of the scientific, economic, and social aspects of farming.

A conservation programme in severely eroded areas requires major capital expenditure for reclamation and for the construction of necessary protective earthworks, but a sound conservation plan, in which protective works and land use procedures are correctly integrated, will not only pay off the capital expenditure over a period of years, but will show a handsome profit on the investment and—most important—the productive value of the land will be preserved for future generations.

Where erosion damage is extensive, the cost of reclamation is usually high, but if control measures are adopted in the early stages of erosion (or better still before it commences), the cost is comparatively low, and most of the topsoil can still be retained in its productive state.

In the United States of America, where conservation programmes have been implemented on approximately 100 million acres of farm lands over a period of about 15 years, authoritative figures are quoted, following a survey in 1946. This survey embraced 10,000 farms in

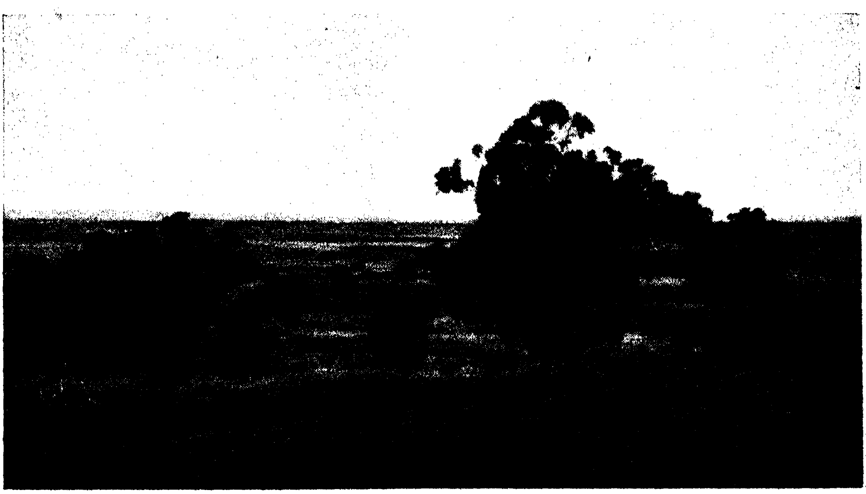


Plate 36.

SOWN PASTURES AT EAST FUNNELL CREEK.—Rhodes grass on the flat and common Guinea grass on the hill.

all parts of the United States—farms on which comprehensive programmes of soil, crop, and water management had been adopted; these farms showed a per acre increase in the yield of major crops amounting to 36 per cent. over the average yields obtained before the programmes were undertaken. Individual cases are quoted. In one instance a farmer invested the equivalent of £12 per acre for the conversion of his farm to a balanced land use programme over a period of 10 years. Over this period, the additional return from the investment was equivalent to £18 per acre. This was enough to liquidate the full cost of the programme and leave the farmer an additional 50 per cent. for his efforts; the major portion of the original investment will remain on the land as a permanent improvement.

Numerous other cases can be quoted from overseas, and similar trends are observed in Australia, but the time period of application of soil conservation measures here is still too short to quote authoritative figures.

Conservation farming *will* prevent deterioration of the farming lands, and it will pay a cash dividend in the process. Even at a stage of serious soil depletion the total expenditure required to adopt complete soil conservation procedures will, in most cases, represent only a small repair charge (1 per cent.) against the land for the period of its productivity in the past.

CONSERVATION FARMING.

Conservation farming is, as a rule, only a little more difficult than current agricultural practice, and, as has been shown, if carried out continuously gives better yields than the older and more wasteful methods.

The first approach to conservation farming, however, entails the efficient use of every acre in accordance with its capabilities. To do this, the farmer needs not only an inventory of his land and its capability, but also the help of an experienced farm planning technician, who can furnish suggestions and help in designing measures that will save and build up the soil. The entire farm must be considered and the various soil conservation practices planned to meet the needs of the particular farm; seldom will a single practice do the whole job, no matter how well it is carried out.

Land Capability.

Land capability is the suitability of land for a permanent specified use; for example, some land is suitable only for forestry purposes, some only for pasture, whilst some may be utilised permanently for cultivation. To a certain extent in the past, land has been classified in terms of its ability to grow particular crops, but seldom in relation to its ability to produce them permanently. *Most farmers, however, have failed to realize fully that sloping land cannot be permanently and safely farmed by level-land methods.* Straight fences were erected, straight furrows ploughed, and straight rows planted, and no attempt made to fit farming methods to land conformation.

Wise land use is influenced by the nature of the soil, the degree to which it has been affected by erosion, the slope and the climate, as well as the physical properties of the soil; of these, erodibility, considered in conjunction with degree and length of slope, is the deciding factor in the determination of the suitability for cultivation.

In the United States of America, eight land capability classes are recognized, varying from Class 1 land which is level and with a negligible erosion hazard to Class 8 land which is too steep or too wet for cultivation, pasture, or forestry purposes, but which may still have value for wild life preservation. For the present, this standard classification has been adopted for use in Queensland, but it is anticipated that, when further data are accumulated, modification may be necessary.

The United States Soil Conservation Service classification is as follows:—

Class 1: Land suitable for cultivation without special practices. It must be workable, level or nearly level, and not subject to more than slight erosion. It usually requires sound crop rotations and correct tillage practices to ensure maintenance of soil structure and fertility.

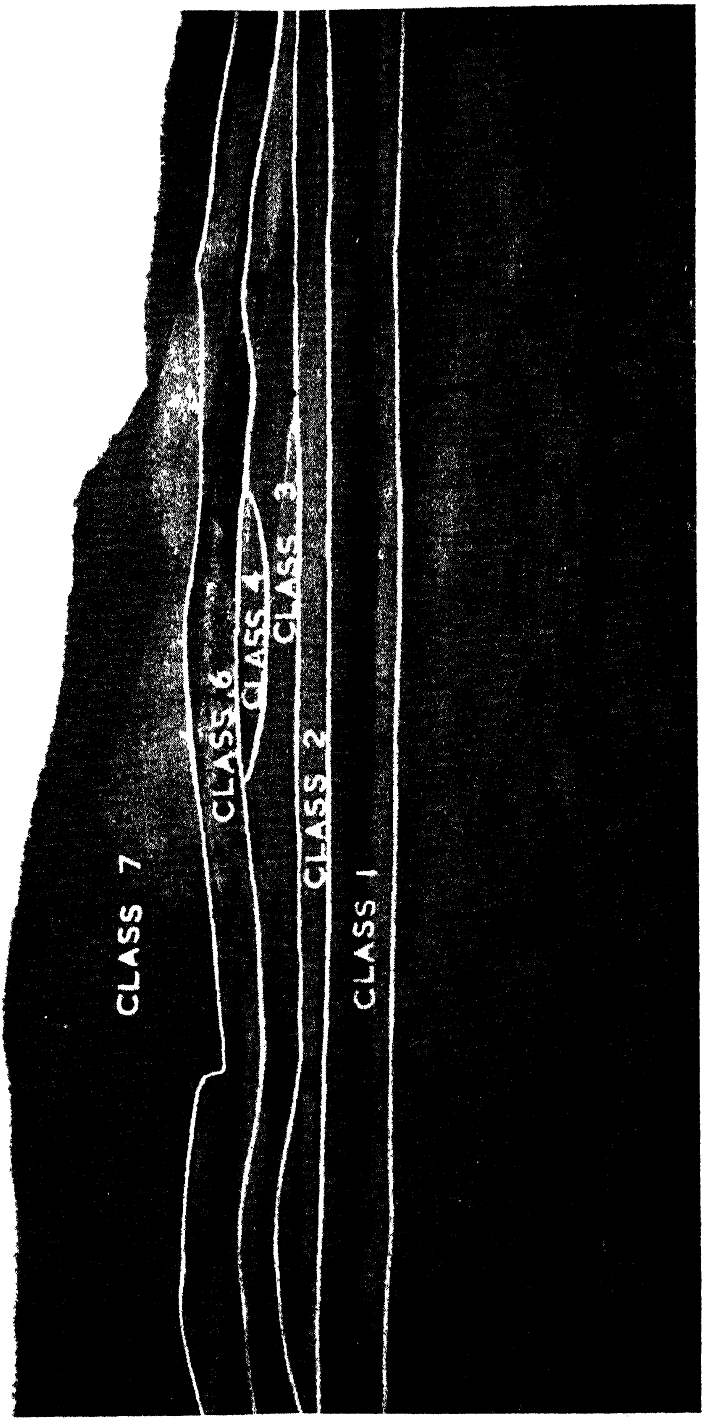


Plate 37

INDICATING LAND CAPABILITY CLASSES FOR A TYPICAL QUEENSLAND FARMING AREA.

Class 2: Land suitable for cultivation with simple special practices. The types of practices likely to be needed are for erosion control and moisture conservation; they include contour tillage, strip cropping, crop rotation, simple water diversion systems, rough tillage, stubble mulching and basin ploughing. These lands usually possess a fairly absorptive soil on moderate slopes.

Class 3: Land suitable for permanent cultivation, but only by the application of intensive erosion control or soil management practices. These will include those for Class 2, but with much more comprehensive systems of water diversion, including waterways, diversion banks and contour banks. Most of Queensland's eroded arable land falls within this class and requires the application of virtually all known soil conservation practices.

Class 4: Land which is suitable for occasional or limited cultivation only. It may be steeper than Class 3 land, more severely eroded, more susceptible to erosion, less fertile, or otherwise less suitable for cultivation than Class 3 land. It is best suited for permanent pasture, but, if complete soil conservation practices are applied, it may be cultivated intermittently.

Class 5: Land which is not suitable for cultivation, because it is too stony or too wet, but may be used for grazing or forestry purposes. It must be nearly level and not subject to wind or water erosion; no special soil conservation practices are required.

Class 6: Land which is not suitable for cultivation but may be utilised for pasture or forestry purposes with moderate restrictions. It is usually moderately steep, and subject to water or wind erosion. The restrictions required include careful pasture management, reduced stocking, and avoidance of "burning-off" practices.

Class 7: Land not suitable for cultivation, and requiring severe restrictions if it is to be used for pasture. Most of this land is steep, rough and eroded and requires very careful management, including the provision of pasture furrows to reduce erosion risks. Such land should in general be reserved for forestry purposes.

Class 8: Land not suitable for cultivation or for the production of useful permanent vegetation that may be harvested under grazing or woodland use. It is chiefly rough, extremely stony land, or swamps that cannot be drained.

Planning for Conservation.

A farm conservation plan represents a physical inventory of the farm. First, it divides the farm into its land capability classes, and then sets out for each of these parcels of land the type of farming procedures necessary to enable permanent production in accordance with the capability. The land capability classification, once made, is fairly permanent; but changes, either in the land or in the methods which can be employed for using or protecting it, may make re-classification necessary later.

The points involved in the preparation of a conservation plan for a typical farm are illustrated in Plates 38-40.

Plate 38 is an aerial photograph of a once highly productive Darling Downs farm. The evidence of the ravages of erosion, most of which has occurred in the past 20 years, is only too obvious. Crop yields

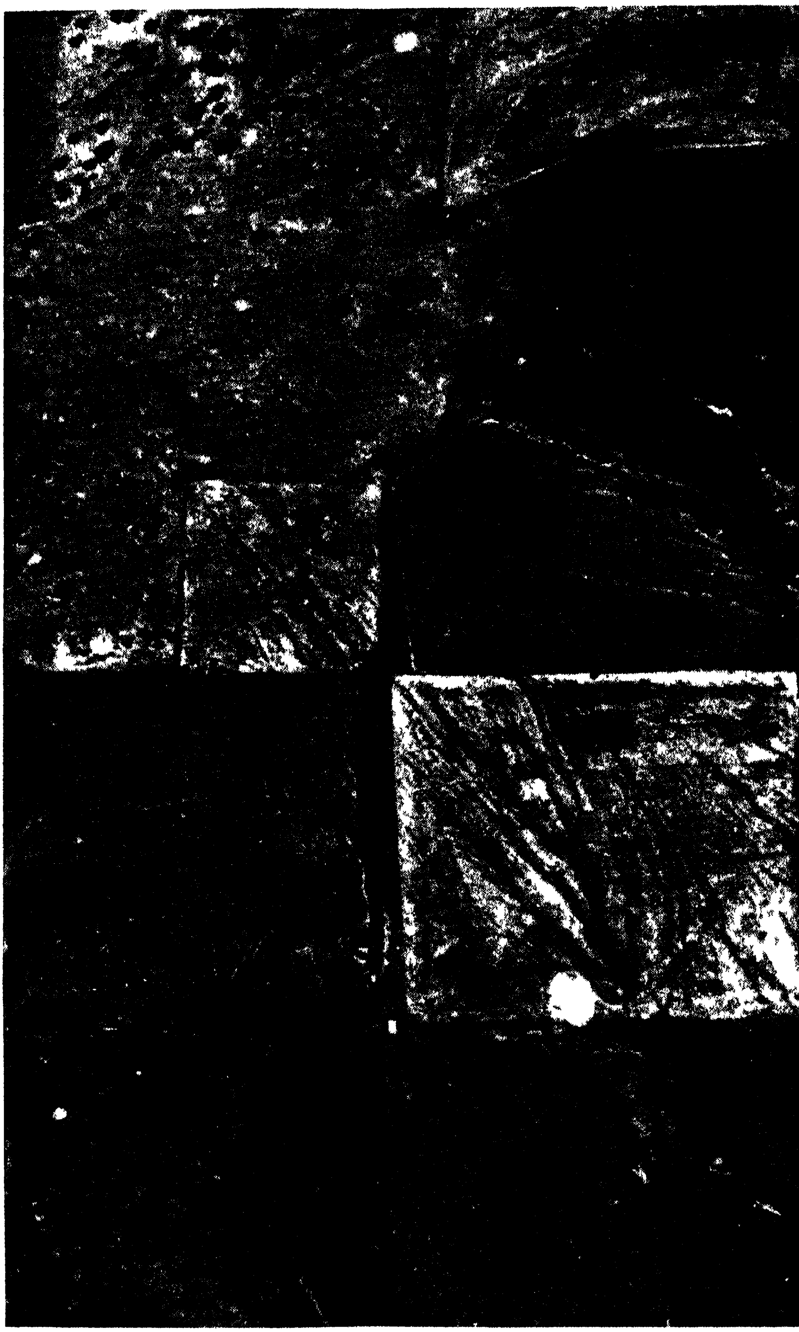


Plate 38
AN AERIAL PHOTOGRAPH SHOWING RAVAGES OF EROSION

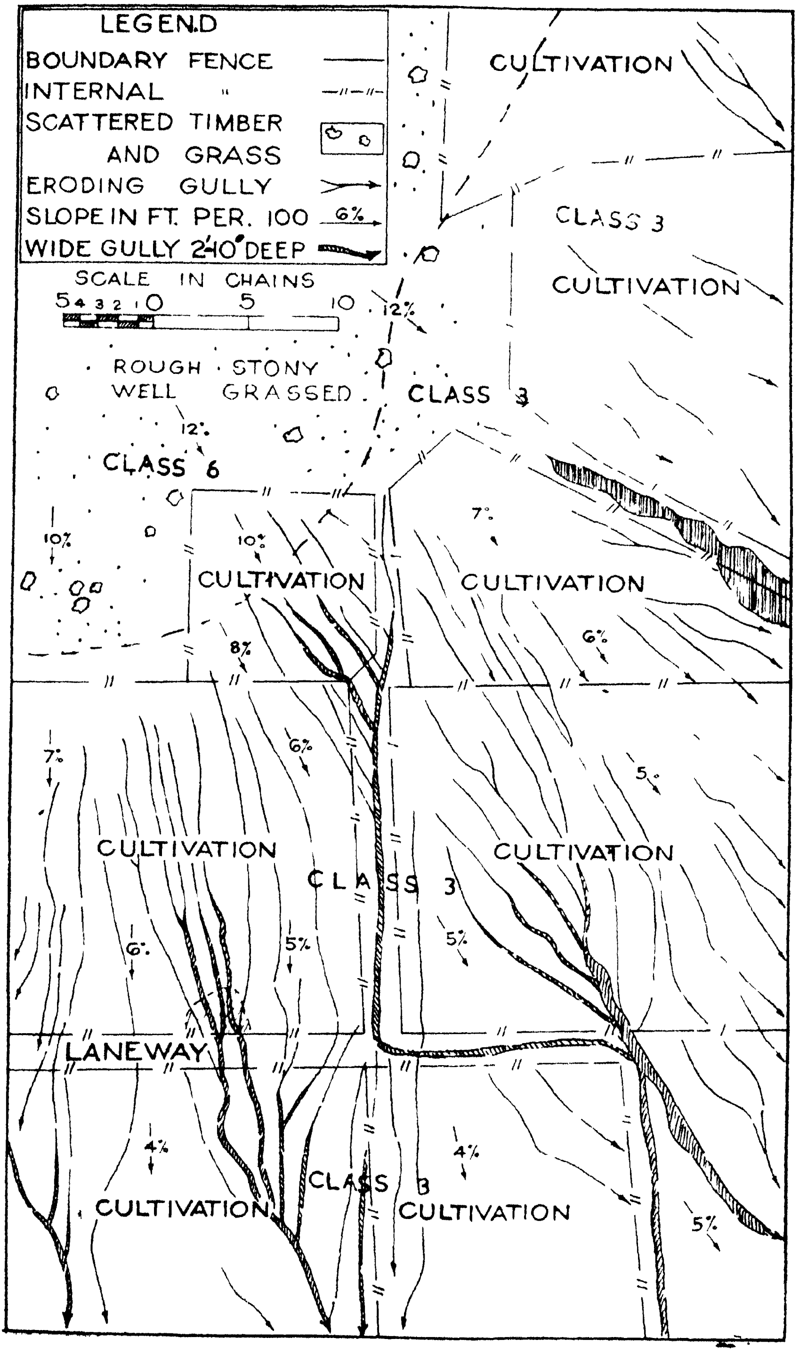


Plate 39.
CLASSIFICATION OF FARM AREAS SHOWN IN PLATE 38.

markedly declined and the owner requested the advice of the Soil Conservation Service in an endeavour to solve his problem. Following detailed examination of the farm and after due consideration of slopes, soil type, &c., the map illustrated in Plate 39 was prepared.

It will be seen that there are only two land capability classes on this area but it is important to realize that each class demands its own specialised treatment. The Class 6 land, because of excessive slope, should be utilised permanently as grassland, and certain pasture improvement practices, such as topdressing and pasture furrowing, must be adopted to ensure the maintenance of maximum productivity. The Class 3 land may be permanently used for cultivation, but only by the adoption of very intensive soil conservation practices, which include periods of retirement to pasture. In order to carry out contour cultivation methods efficiently, the re-location of fences around the contours becomes a necessary part of the farm plan.

Following preparation of the land capability plan for the farm, the conservation or agricultural technician discusses with the farmer the procedures to be adopted, which will be governed not only by technical considerations but also by the farmer's resources, his type of farming, choice of crops, and many economic and personal factors. The over-all land use plan is then prepared, and all subsequent effort aims at completion of the work in accordance with the plan, whether it takes one year or 10 years to accomplish.

The consummation of all these considerations is represented in Plate 40. It is more than a map of the farm; it is a plan for the future, and incorporates rotational practices, soil conservation works, farm dams, and the numerous details so necessary to provide a blueprint for the permanent economic usage of the property.

Since all details of the plan are discussed with the farmer during its preparation, he is completely familiar with its objectives and can readily interpret it in his daily farming operations. The soil conservationist is able to integrate the farm drainage lines into the group drainage plan for the area; each farm plan then forms part of a solid conservation mosaic for the whole catchment area, avoiding dissension between property owners regarding water disposal.

Farm planning is not always simple, but approached carefully and all aspects discussed between the farmer and the farm planning technician, the difficulties can normally be overcome.

EXPLANATION OF PLATE 40.

LAND USE PROGRAMME.

Class 6 Land.

(1) Topdress with 1 cwt. superphosphate per acre.
(2) Avoid pasture burning.
(3) Practise conservative stocking.

Class 3 Land.

(1) Adopt a three-course rotation including wheat, cowpeas, and pasture—land to be retired to pasture for three years in ten.
(2) All crop residues to be retained, preferably as a surface mulch.
(3) Contour cultivation to be practised.
(4) 1 cwt. of superphosphate per acre to be applied at time of wheat planting.

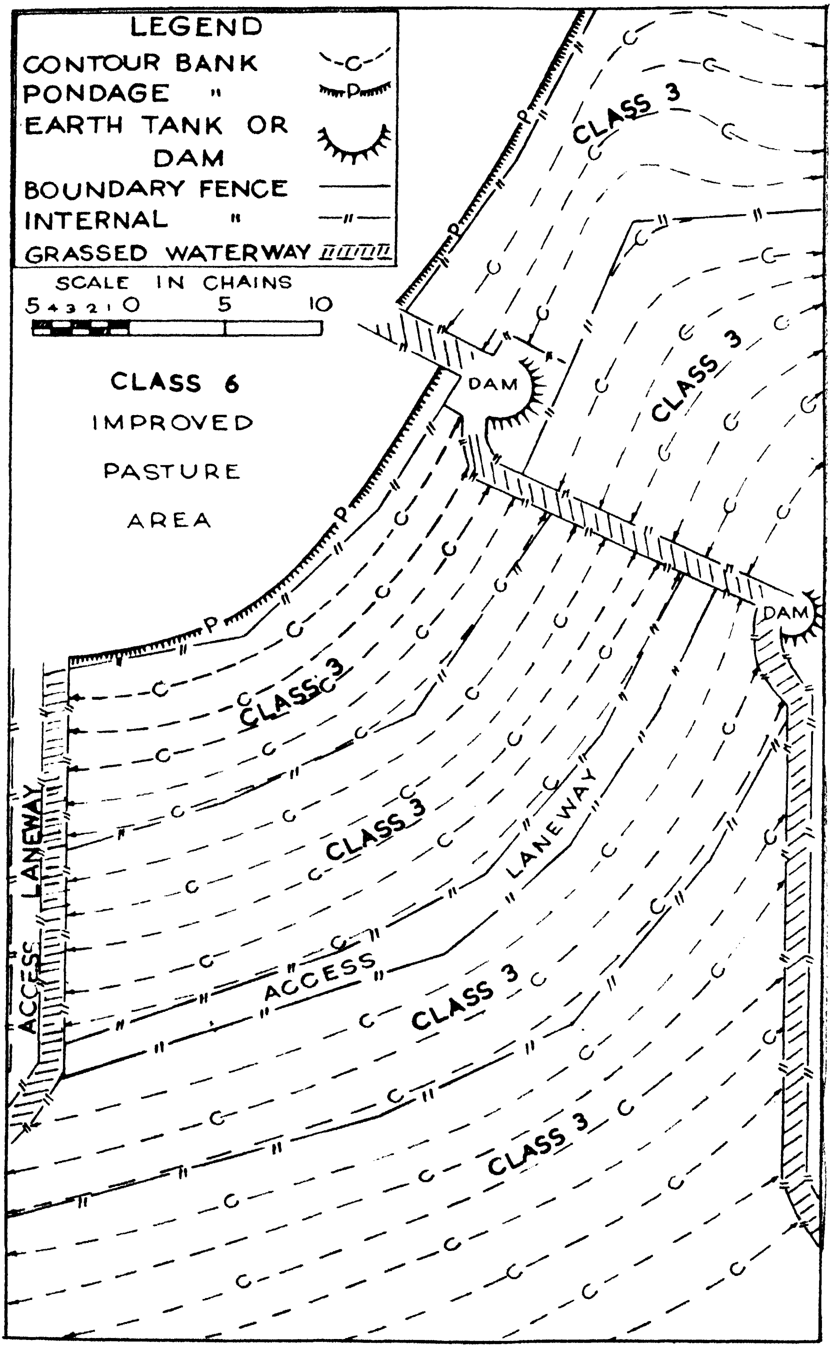


Plate 40.

PLAN FOR SOIL CONSERVATION ON FARM SHOWN IN PLATE 39.

Objectives in Conservation.

The things which must be done to reduce or control water erosion will be more apparent if the objectives are set out. These include the following:—

1. Ensuring the maximum penetration of rain through the soil surface, and holding the surface soil particles firm against movement by raindrops.
2. Maintaining such soil structure that rain, once through the surface, is readily passed on to the lower layers.
3. Making provision for the temporary ponding of rain on the site where it falls, so that additional time is allowed for penetration.
4. Providing for interception, at intervals down a slope, so that the run-off water does not attain a scouring velocity.
5. Providing stable, well-grassed waterways from catchment to watercourse, so that run-off can be safely transported from the farms to the rivers.

If these points are appreciated, then the approach to soil conservation is simplified. It is quite obvious that the successful control of erosion in any area is dependent on an enthusiastic approach to the problem by all landowners in that area. Each must endeavour to retain the maximum amount of rain on his land, and must ensure that unavoidable run-off is transferred from his land in such a manner that a minimum amount of soil is transported. Farm drainage lines must be capable of being incorporated to form part of a group drainage pattern.

Conservation measures may be broadly divided into:—

1. Those utilising vegetation or plant residues to ensure maximum protection of the soil and to maintain soil structure and fertility.
2. Those utilising mechanical treatment of land to ensure maximum pondage of surplus rainfall or to transport it safely from the land.

[TO BE CONTINUED.]

THE QUEENSLAND YEAR BOOK, 1948.

The ninth issue of the Queensland Year Book has just been published by the Government Statistician and is available at bookstores for 2s. It retains the same form as previous issues, with later figures inserted in all the statistical tables, and several new features have been incorporated.

The more important sections of the new material added to this issue are as follows:—

Maps showing percentage increases or decreases of population in Queensland Local Authority Areas between the 1933 and 1947 Censuses.

A detailed description of the new Wheat Stabilisation Plan.

Diagram showing percentage increases in retail prices since 1938-39.

Table giving the industries of the Queensland working population at the time of the 1947 Census.

Diagram showing basic wage increases since 1938-39.

Agriculture, other than Sugar Culture, in the Mackay Area.

N. E. GOODCHILD, Senior Adviser in Agriculture.

(*Continued from page 31 of the January Issue.*)

PASTURES.

Native Pastures.

Native pastures consist generally of coarse, rank grasses such as giant spear (*Heteropogon triticeus*), blady grass (*Imperata arundinacea*), kangaroo grass (*Themeda australis*), pitted blue grass (*Bothriochloa decipiens*) and extensive tracts of spear grass (*Heteropogon contortus*). These grasses are palatable for a short time after being burnt off, but rapidly decline in nutritive value. Over a number of years, little variation occurs in the very light carrying capacity of the poorer class pastures. Spear grass, however, is much superior to most other coastal grasses and in the coastal areas has a carrying capacity of a beast to 7 or 10 acres.

Sown Pastures.

Para grass has proved highly successful and has been established where conditions are suitable on the open plains at St. Lawrence, Inneston and Proserpine and on smaller holdings in the Mackay area. Ample moisture is essential to its successful growth.

In the O'Connell River and East Funnell Creek (Plates 41 and 42) areas, Rhodes grass and paspalum have been the most prominent pasture species used, whilst limited areas of molasses, common Guinea and Para grasses have been planted with success. However, Rhodes grass and paspalum have not proved entirely satisfactory. The former does not thrive as well under tropical conditions as in the sub-tropical areas; there is a lack of vigour and stooling, and general growth is spindly. Paspalum is somewhat sour throughout the wet season but improves and becomes palatable in late autumn and winter. Unfortunately, no better substitute grass has so far been introduced in this area.

Grasses which have given great promise in the O'Connell River and East Funnell Creek areas are Kenya No. 1 Rhodes grass and green panic (*Panicum maximum* var. *trichoglume*). The former is more vigorous than the common Rhodes grass and is much slower in maturing, thus providing succulent feed for a longer period. Green panic is a rapid grower and produces a heavy body of soft succulent feed. The rapid expansion of these two grasses is being carried out in both areas.

The pasture problem on Eungella Range (Plate 43) is completely different from that presented on the coast. The range varies in altitude from 2,000 to 3,000 feet and this elevation produces sub-tropical conditions. The rainfall is much heavier than on the coast, the average being approximately 80 inches per annum. The soils are mostly of granitic origin, with some red volcanic loam on the plateau. The main pasture grasses are Rhodes grass, paspalum and kikuyu grass. Cocksfoot (*Dactylis glomerata*), Toowoomba canary grass (*Phalaris tuberosa*) and rye grasses (*Lolium* spp.) have been tried but are not persistent and are not favoured.

The usual practice is to plant scrub burns with a mixture of 3 to 4 lb. of Rhodes grass and 6 lb. of paspalum. During the first year, Rhodes grass predominates while paspalum is becoming established. In the second and subsequent years, the latter extends in the pasture at the expense of the Rhodes grass, which tends to die out after several years.

Plate 41.

SOWN PASTURES AT EAST FUNNELL CREEK.—Rhodes grass on the flat and common Guinea grass on the hill.

The country is somewhat broken and is steep in some areas. Such conditions do not lend themselves readily to pasture renovation. Kikuyu grass is rapidly extending and its matlike growth ensures the holding of the surface soil, preventing sheet erosion. It is established by planting cuttings approximately 4 to 6 feet apart which cover the interspaces in the course of a year or two. Kikuyu grass has proved valuable also in preventing the ingress of carpet grass (*Axonopus compressus*). Kikuyu grass, planted along some farm boundaries, has been found effective in preventing carpet grass intruding on pasture land. By careful pasture management and its early eradication in paddocks when observed, carpet grass can be controlled in pastures on the Eungella Range. By these methods, the deterioration of good pastures and the

Plate 42.
A PLANT OF COMMON GUINEA GRASS ON AN EAST FUNNELL CREEK FARM.

lowering of the carrying capacity by carpet grass intrusion can be avoided. In the early period of development of scrub land, heavy stocking is often necessary until sufficient areas are cleared to provide a living. Such treatment of new pastures causes deterioration and permits carpet grass to become established, thus lowering the carrying capacity of the country. The amount of fallen timber, satin ash or Eungella gum (*Eugenia smithii*) particularly, also reduces the carrying capacity in this area, since in some paddocks up to 25 per cent. of the land is covered with logs which do not burn readily. This, together with the broken contour of the country, provides a difficult problem in pasture renovation.

Plate 43.
A TYPICAL DAIRY FARM ON THE EUNGELLA RANGE.

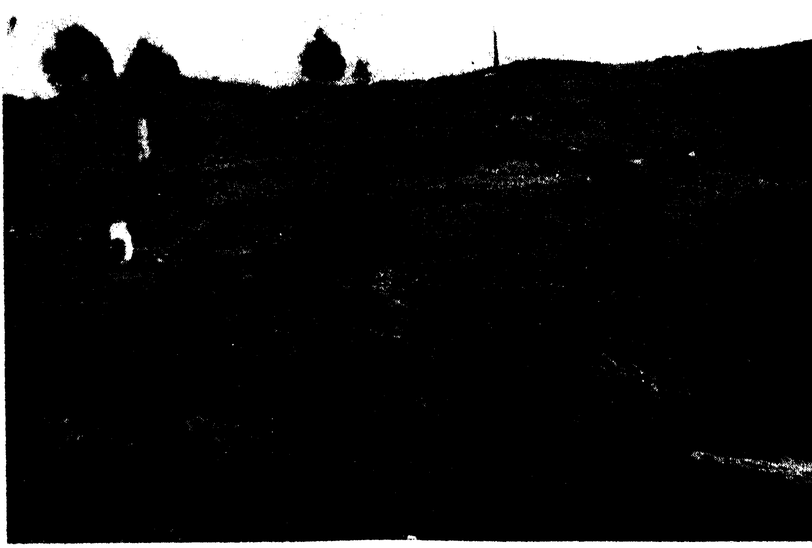


Plate 44.
WHITE CLOVER IN AN EUNGELLA RANGE PASTURE.

Pastures Legumes.

Native pasture legumes are of little importance but two introductions—namely, Townsville lucerne (*Stylosanthes sundaica*) and white clover—are achieving prominence. The so-called Townsville lucerne, an annual legume, has spread rapidly during recent years and is now to be found over a very wide area between St. Lawrence and Bowen. In some areas at Bloomsbury, Proserpine and Salisbury, extensive areas are now covered with this valuable legume. It thrives particularly on poor, hard, stony ridges and poor sandy soils. Although it will grow on heavier soils, it regenerates more prolifically on the poor hard types of soil. The seed germinates with the first heavy summer rains and the plants continue to grow into early winter, when they reach maturity and seeding takes place. Stock eat the early growth but prefer the plant in a more mature stage in May, June and July. In the dried-off state it is relished by stock and in the drier areas it is largely responsible for the good condition of stock when pastures are bare. A very useful purpose is being served by this valuable annual and its continued dispersal will prove an asset to pastures in the Mackay area.

The elevation of Eungella Range, with its sub-tropical climate, has proved eminently suitable to the growth of white clover (Plate 44). The plant is now established throughout the district and is rapidly extending on individual farms in competition with paspalum, Rhodes grass and kikuyu grass. Actually, the encroachment of clover on established pastures is causing concern to farmers in cases where grasses were crowded out by white clover during the winter of 1948. However, it is hoped that the introduction of the clover will arrest the loss of soil fertility and eventually effect an improvement in the fertility of the land, at the same time providing good pasture during the winter and early spring months.

Another legume worthy of mention which abounds in wetter portions of the Mackay area is the introduced sensitive plant (*Mimosa pudica*). Though considered a pest of cultivation, it appears to be a useful legume in pastures. The leaf growth and tender stem terminals are relished by stock. Usually it persists for several years in pastures before dying out.

WEED PROBLEMS.

Lantana (*Lantana camara*) provides probably the major weed problem in the Mackay area. This pest has made steady advances on both open forest and rain-forest country. On the poorer class of country the present cost of clearing is excessive. On the more valuable rain-forest areas, efforts have been made to eradicate lantana by the use of bulldozers followed immediately by the planting of introduced grasses such as kikuyu, Rhodes and Guinea (*Panicum maximum*) grasses.

Control of lantana by spraying with weedicides has been given some attention. This method necessitates the brushing of old growth and the spraying of the regrowth which takes place. When large areas are to be cleared, this work is slow, laborious and costly.

Devil's fig (*Solanum torvum*) is a major weed pest, particularly on scrub areas of the district. It is, however, easily controlled in its early stages by arsenical and hormone-type weed killers.

Noogoora burr (*Xanthium pungens*) may be observed in isolated areas along creek banks but cannot be regarded as a serious problem at present.

Sensitive weed (*Mimosa pudica*) is widespread throughout the district. It is generally regarded as a pest in a cultivated area because of the sharp prickles along the stems which at times cause blood-poisoning in people.

AGRICULTURAL CROPS.

Fodder Crops.

Coastal pastures are generally of inferior types and their palatability is of short duration. In the past, too much reliance has been placed on natural feed, but more and more farmers are now realising that to maintain continuous production of cream and milk it is essential to provide succulent nutritive feed.

As a summer grazing crop, Sudan grass has proved its worth. Seed is broadcast at the rate of 10 to 12 lb. per acre with the first storm rains. Planting may be continued up to March and April. Plantings carried out before December often consist of a mixture of Sudan grass and Poona pea, but of late years Poona pea crops have not thrived and the practice is losing popularity.

Plate 45.
ALGERIAN OATS AT SARINA.

White panicum, one of the millets, has also proved suitable as a summer feed for grazing. Planted at the rate of 15 lb. per acre in early spring or summer, it later provides excellent succulent feed, but as its regrowth is inferior to that of Sudan grass it is not used so extensively as the latter.

Oats as a winter grazing crop is rapidly gaining in favour. Varieties such as Algerian (Plate 45) and Sunrise have been successfully grown, but at times are liable to failure due to rust incidence, especially under wet conditions and when late planted. In recent years, rust resistant varieties of oats (for example, Victoria x Richland) have been planted with success. A series of plantings is usually made in May and June, and late plantings may extend into July with satisfactory results. Sowing is at the rate of one bushel per acre. Under

favourable conditions of sufficient winter rainfall the crop may be fed down three or four times, providing succulent feed during the winter and early spring months when pastures are normally of little value for milk production.

Maize is not grown extensively as a grain crop as yields have not been satisfactory because the soils in general are not sufficiently fertile or well-drained for this purpose. Isolated crops have produced yields varying from 20 to 60 bushels per acre, but generally the crop is grown for green fodder for farm horses and dairy stock.

Many small areas of sweet sorghum are grown in the Mackay and Bowen districts, mainly as green crops for stock, and this crop could be more extensively grown.

Lucerne is selective in its soil requirements and is sensitive to soil acidity. Many of the Mackay soils are very acid and are not suitable for the satisfactory growth of lucerne; However, small areas have been grown on particularly well-drained creek flats. The general high-water table during a wet season rots the root system, and this, together with competition from excessive weed growth during early summer, so weakens the lucerne that crops rarely survive the first wet season. Treated as an annual crop, lucerne has proved a good standby during the dry springs and could be more extensively grown for grazing or cut for hay purposes to augment fodder reserves on the farm.

Fodder conservation is recommended in the Mackay area and both sorghum and maize could be grown more extensively for silage purposes.

Potatoes.

Prior to the war years potato production was mainly limited to small areas for home consumption. When increased production of essential foodstuffs was required during the war for the greatly increased population in North Queensland, the area under potatoes was expanded rapidly to 700 acres. With the end of the war the demand eased, and in recent years production has not exceeded 250 acres, the yield from which is absorbed locally.

Average yields of 2½ tons per acre have been harvested over several years, whilst that for the 1948 season was in the vicinity of 3 tons per acre.

There are no well defined potato-growing areas, the crop being produced mainly on the well-drained river and creek alluvial flats and scrub areas throughout the Mackay and Proserpine areas.

The heavy rains which normally occur in January, February and March preclude planting until after the wet season. Planting is therefore delayed until mid-March at the earliest and continues to the end of May or early June. It is desirable to plant uncut seed to avoid the rotting of seed potatoes that occurs if wet season rains extend longer than usual. Frosts occur along the coastal belt in isolated areas and in these areas it is essential to plant early to avoid the risk of loss of crop by frosting. June rains are fairly reliable and occur at an opportune time to set the early planted crops. Invariably, crop yields are heavier from early planted than from late planted crops. A further advantage is the fact that the risk of damage from potato moth infestation is minimised. Moreover, late planted crops usually do not store well. The general aim is to complete the harvesting by late September or early October. The late crop, however, can with safety be grown on the Eungella Range with its cooler spring conditions.

Tobacco.

Some tobacco crops have been grown successfully in the Mackay and Sarina districts in past years. Climatic conditions are, however, precarious for tobacco production, especially summer-grown crops. Heavy summer rains often produce waterlogged conditions which favour the development of blue mould disease in the field even where clean plants are planted out after treatment with benzol. Crops planted in late summer and early autumn meet with a sudden drop in temperatures, again often resulting in blue mould development in the field. Following unsatisfactory crop results over a period of years, tobacco growing has been discontinued in the Mackay and Sarina districts. To establish tobacco growing it would appear that the crop should be grown in the spring with the aid of irrigation.

The drier conditions of the Bowen district are more suitable for tobacco, especially where irrigation facilities are available. Good crops have been grown there in the past, and in recent years more interest has been shown in the crop.

Cotton.

Small areas of cotton have been grown for some years in different parts of the Mackay area, with varying degrees of success. Isolated crops in the Carmila and Ilbilbie districts have produced up to 1,500 lb. of seed cotton to the acre. The latter district appears to offer the greatest possibilities for cotton growing in the Mackay area.

Suitable soils in this district are grey clay loams overlying a pervious clay subsoil at a depth of 18 to 24 inches. This soil type appears to offer adequate drainage and at the same time is sufficiently retentive of soil moisture to ensure that growth of the cotton plants is not seriously checked.

Conditions in the Mackay area during the heavy wet season compel planting to be so arranged that there is a good chance of dry weather at harvesting. It has been found by a series of plantings over a number of years that late December planting is the most appropriate time. This generally allows the crop to become established and develop a root system before the wet season sets in. The Ilbilbie soils have sufficient drainage to avoid waterlogging and the crop is grown through January to May and harvested in June and July. Winter rains are often experienced but are generally of short duration and are not detrimental to the production of good grade cotton. Overall climatic conditions and soils in the Mackay area are not considered suitable for successful cotton-growing.

Onions.

This crop is grown to a small extent, but though fair yields have been obtained in many parts of the district the monetary returns obtainable from other small truck crops in recent years have been a greater attraction to farmers. Crops grown at Eungella Range have been most successful, yielding up to 15 tons per acre with both Hunter River (white) and Brown Spanish varieties.

HORTICULTURAL CROPS.

Horticultural activities were considerably accelerated during the war years when the growing of small truck crops reached a peak. Production since then has declined. Tomatoes are grown extensively in the Bowen area during the winter months and to a lesser extent in

Mackay. Pumpkins are regarded as a winter crop but are not extensively grown outside the Bowen area, which is the principal centre of production of this crop.

Banana growing has expanded considerably in recent years, the fruit being marketed mainly on the southern markets. The largest plantings are on the easterly scrub slopes at Carmila, whilst the acreages at Netherdale, Seaforth, East Funnell Creek and Proserpine are increasing.

Pineapples are produced chiefly in the coastal areas at St. Lawrence, Bucasia, Seaforth and Bowen. These crops benefit by early maturity under northern conditions.

Papaws are grown on well drained scrub areas at Seaforth and in numerous other centres in the Mackay district and find a ready sale on southern markets. Passion fruit have been given more attention in recent years in the Seaforth, Carmila and West Plane Creek areas. Interest in mango growing has increased and new groves have been planted at Rosella and Bucasia.

Climatic conditions prevailing in the Mackay area are favourable for the production of tropical fruits and present indications are that there will be an extension in the areas devoted to these fruits.

DAIRYING AND PIG RAISING.

The Port Curtis Co-operative Dairy Association established a butter factory in Mackay in 1930 and the dairying industry has steadily expanded since that date. The factory manufactures butter for local consumption and pasteurises milk for distribution. The local consumption of milk increased rapidly during the war years and has since risen steadily to a figure of 398,000 gallons per annum. The present number of suppliers is approximately 200. Dairying was originally conducted in conjunction with cane growing, but this is not generally practised now. Although dairying is carried on in isolated areas throughout the Mackay area, several districts depend almost entirely on dairying as the main source of income.

Eungella Range, with an average rainfall of 80 inches per year, is the largest concentrated dairying district. In the O'Connell River area, dairying and mixed farming are carried on in a rainfall belt of 60 to 65 inches. Here the pastures consist of Rhodes grass, paspalum, *Urochloa trichopus* and green panic. The last named is one of the most promising grasses established in the Mackay area.

The Sarina Range, East Funnell Creek and Blue Mountain districts are devoted almost entirely to dairying. The rainfall varies from 56 to 65 inches per year and the dairying industry is well established in these districts. Dairy farmers are showing greater interest in fodder conservation and it is anticipated that additional silos will be constructed in the near future.

The dairy breeds finding most favour are Jerseys and Illawarras, while Guernseys, Friesians and Ayrshires are also represented.

Pig raising declined considerably during the war years. The industry, however, is capable of being built up again. A factor militating against its more rapid recovery is the greatly increased local demand for whole milk and the limited and uncertain supply of skim

milk available for feeding to pigs. The demand for whole milk continues to expand and the prospects of raising pig production to previous levels are not encouraging at present.

THE GRAZING INDUSTRY.

The grazing holdings are extensive and consist chiefly of grazing farms and pastoral holdings. They vary in area from 40 square miles to 130 square miles. The carrying capacity of Nebo country varies considerably. On the open forest country, the carrying capacity is 1 beast to 12-15 acres, whilst on the brigalow country this diminishes to 1 beast to 30-40 acres.

Grazing is extensively carried on along the coastal belt from St. Lawrence to Bowen within a rainfall belt of from 30 to 70 inches. There is a preponderance of spear grass associated with pitted blue, blady and other coarse grasses. On the plain country of St. Lawrence, Inneston and Proserpine, Para grass has been successfully established and areas planted to this grass are being steadily increased. Of considerable importance is the wide distribution of Townsville lucerne along the coastal belt, which adds appreciably to the value of the grazing potentialities of the area. The principal grazing areas are, however, located in the Nebo district, west of the main coastal range. The rainfall in this area is generally regarded as fairly reliable. Pastures consist chiefly of spear grass, but other grass species are also found. A total of approximately 120,000 head of cattle are grazed on this area, of which 10,000 head are slaughtered yearly for local consumption.

FORESTRY DEVELOPMENT.

Some 20 years ago, silvicultural work, mainly planting of kauri and hoop pines, was undertaken at Bee Creek on the Eungella Range. The project was later abandoned and the planted area was made a National Park. Large quantities of heavy and light scrub-wood and hardwood have in the past been obtained from the Eungella Range and the area is still being worked. Most of the sawn timber is marketed in the south and logs are also supplied for plywood purposes. During 1948, the amount of timber harvested from Eungella exceeded 5,000,000 super feet.

DAIRY FARM COMPETITION.

Officers of the Dairying Division of the Department in January commenced the preliminary inspection of the 135 farms entered for the Dairy Farm Competition and the task is expected to be completed early in February.

The competition is being conducted in 16 zones in Queensland from funds allotted from the Commonwealth grant for improving efficiency in the dairying industry. The prizes to be awarded in each zone are £70 and trophy, £20 and pennant, and £10 and certificate, respectively, for first, second and third farms.

The final inspection of farms likely to be prize winners will be made by officers of the Divisions of Plant Industry, Animal Industry and Dairying during July.

Specifications for the Construction of a Tobacco Baling Press.

E. W. BAIRD, Adviser in Agriculture.

FROM time to time requests are received from tobacco growers regarding the construction of a tobacco baling press. Details of a suitable type of press are given in this article and the accompanying illustrations (Plates 46 and 47).

Plate 46 shows the press without the sides and lid. The top bar is dressed 5 x 5 hardwood 45 in. long; the end upright posts are dressed 5 x 3 hardwood with an overall length of 65 in. The ends, flooring and sides are made from dressed T. and G. pine, 1 in. thick.

The ends are 22 in. by 36 in. and the floor 24 in. by 38 in., outside measurements. The base boards under the floor consist of one central 5 x 5 dressed hardwood piece, with 5 x 2 dressed hardwood boards on the sides.

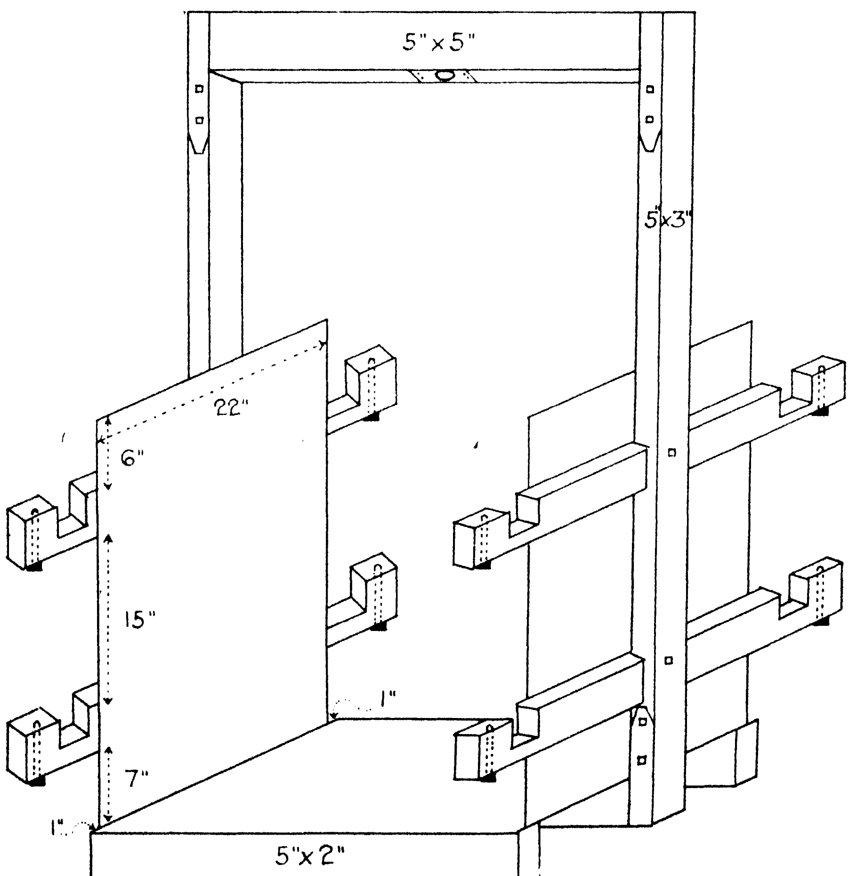


Plate 46.
DRAWING OF PRESS WITHOUT SIDES OR LID. (Not to scale.)

The centre guide for the top of the bottle jack, situated under the top bar, is a piece of iron 5 x 4 x ¼, with the central portion pressed outward to fit the top of the jack.

The cross pieces on each end of the press are made from 4 x 2 dressed hardwood. The cut-outs are bevelled to hold the corresponding pieces on the sides of the press. The straight cut is nearest the press and 1 in. from the side edge with the bevel cut 3¼ in. on the outside to 3½ in. on the inside of the timber. On the outside of the bevel cuts, sufficient timber is left to receive a 4½ x ⅜ bolt. This is to prevent splitting of the timber when the pressure is applied with the wedges. These cross pieces are checked into the uprights and bolted to them with 4½ x ⅜ bolts.

The top bar and the bottom centre bar under the floor are strapped on to the end uprights by iron U straps 12 x 5 x ¼ and bolted securely with 6½ x ½ bolts. In all, eight 6½ x ½ and twelve 4½ x ⅜ bolts are required.

To make a neat bale, ten 1 in. square pieces 36 in. in length may be attached to 3-ply wood and placed at each end of the press to act as guides for the hand butts when baling.

Figure 1 in Plate 47 is the end elevation of Plate 46. Figure 2 shows a side of the press. This measures 38 in. by 36 in. and is made of dressed T. and G. pine, 1 in. thick. The cross pieces are 3 x 2 dressed hardwood. The cut-outs are checked to fit the cut-outs in the end cross pieces.

Figure 3 in Plate 47 shows the lid of the press, which is 21½ in. by 34 in. The base is made from dressed hardwood. Across this base at right angles are three 21½ x 4½ x 1¼ dressed hardwood pieces and across these again in the same direction as the long side of the base is one 34 x 9 x 1¼ piece of dressed hardwood. Upon this lid the bottle jack is placed when baling is in operation.

Wedges used in baling are made from 2 in. dressed hardwood. They are flat on one side with a taper from 2 in. to 1 in. on the other side and are 8 in. long.

Method of Baling Tobacco.

Before commencing to bale, the sides are removed from the press. Hessian is placed across the floor of the press and sufficient is left over on each side of the bale to reach half way up the side of the bale when pressed. About 9-12 in. will be found sufficient. The sides are replaced and the wedges are put into position and tightened.

Leaf tied into hands is neatly placed side by side into the bale with the butts outwards. Tie layers are placed in the same manner except that they are situated a few inches towards the centre of the bale. When long leaf with sufficient overlap is being baled, tie layers may not be necessary.

Care must be taken that only leaf of the same grade is put into each bale.

As baling progresses the tobacco is compacted somewhat by the weight of the body. When the top is reached, a piece of hessian similar in length to the bottom piece is placed across the bale, the lid is placed into position and the bottle jack brought into operation. Only sufficient pressure is applied to reduce the size of the bale by about one-third, as overpressing is detrimental, particularly to light textured leaf.

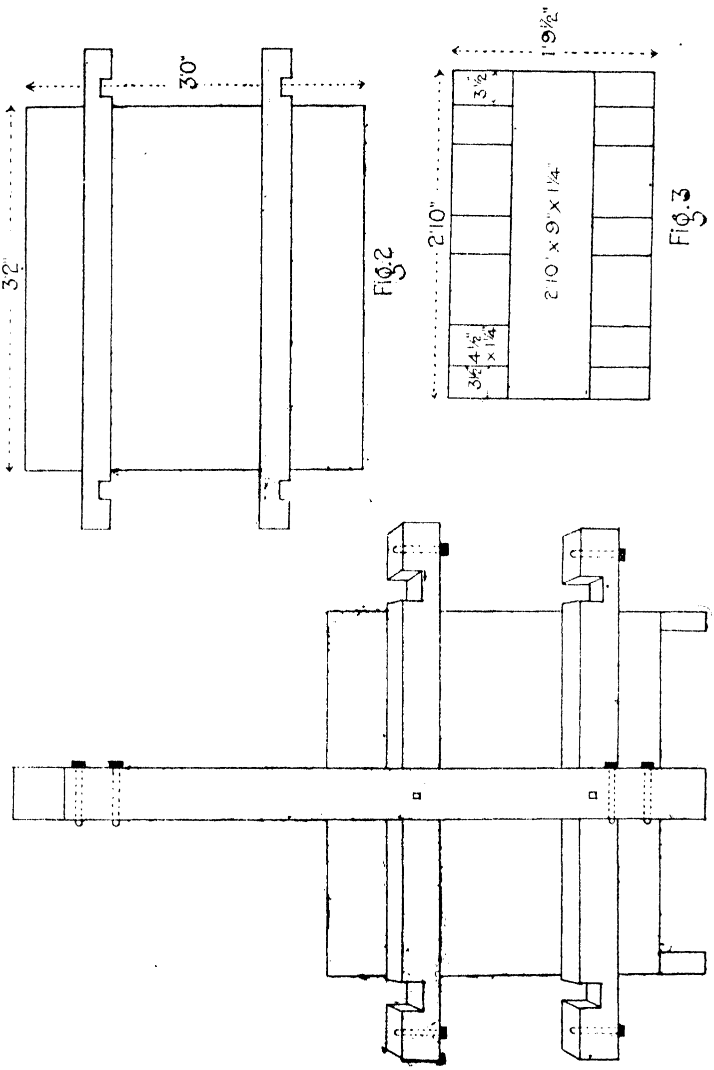


Plate 47.
Fig. 1.—END ELEVATION; Fig 2.—SIDE OF PRESS.
Fig. 3.—LID OF PRESS. (Not to scale.)

Keeping the pressure on, the sides are removed and the ends of the hessian on each side are sewn together. The jack may now be removed. The bale is rolled out, and the hessian ends are cut to fit and sewn on. The bale is then ready for branding.

Experience alone will dictate the amount of tobacco to put into the press, but it is stressed that bales should not weigh more than 150 lb. Overpressing is an easy way to spoil light, bright leaf.

If leaf is being forwarded to an Association or Company for grading it is removed from the bulks, shaken loose and baled as above.

Fertilizing Pineapple Plants.

P. MITCHELL, Senior Adviser in Horticulture

THE present demand for pineapples by both the canneries and the fresh fruit market is such that the prospects of the industry are better than at any time previously. It is therefore essential that the highest possible yields of good quality fruit should be produced on the areas already planted or likely to be planted in the near future. Maximum production will not only assist in stabilising the industry but will also benefit the individual grower financially, and, in any case, this is the only sound basis on which the industry can be expanded.

Greater production per acre can be achieved by most growers in the State; it involves little, if any, additional expense but it does entail greater attention to the following points:—

(1) The use of well drained land with at least two feet of friable soil and subsoil.

(2) Thorough preparation of the land before planting, since the only tillage possible after planting is shallow hand cultivation.

(3) Careful choice of type of planting material. Suckers and slips are planted between mid-September and early October; tops and butts are planted from mid-February to mid-March. In either case, use only the most vigorous plants available.

(4) A fertilizing and cultural programme designed to promote vigorous growth in the plant crop; without a good plant crop, satisfactory ratoons cannot be expected.

(5) Careful handling of the fruit during harvesting in order to eliminate wastage between the farm and the cannery or market.

Of these five points, the correct use of fertilizer is particularly important, and a summary of current recommendations should therefore be of interest to growers.

Fertilizer Requirements.

The main plant foods required by the pineapple plant are nitrogen, phosphoric acid and potash. The standard pineapple fertilizer is a mixture known to the industry as 10-6-10. This mixture is water-soluble and therefore readily available to the plant.

The placement of fertilizer is important, for most of the plant's feeding roots are in the top three or four inches of soil and relatively close to the base of the plant. The fertilizer must, therefore, be applied on the surface of the soil and as close as possible to the base of the plant, preferably in the lower base leaves. As the narrow, trough-like leaves of the plant collect moisture, even from light showers and heavy dew, any fertilizer lodging in the base leaves is dissolved and the nutrient solution thus formed percolates through the soil, where it can be absorbed by the pineapple roots.

Times of Fertilizing.

When suckers and slips are planted towards the end of September, a dressing of 10-6-10 should be applied a fortnight later; the young roots will then be about half an inch long. An application of sulphate of ammonia should be made in midsummer, just before the period of maximum growth, when the demand for nitrogen is greatest. A second dressing of 10-6-10 is required in late summer and a further dressing of sulphate of ammonia late in autumn. The latter enables the plant to maintain its vigour throughout the winter.

Tops planted in March should receive the late summer and late autumn fertilizer applications and then fall into line with standard recommendations in the following spring. For butts planted in March, the late autumn application of sulphate of ammonia is required shortly after planting and standard recommendations apply thereafter.

Although fertilizer practices vary with the soil type and the vigour of the crop, a typical programme would be as follows:—

September-October: 50 lb. 10-6-10 per 1,000 plants;

December-January: 30 lb. sulphate of ammonia per 1,000 plants;

March-April: 50 lb. 10-6-10 per 1,000 plants;

Early May: 30 lb. sulphate of ammonia per 1,000 plants.

(50 lb. per 1,000 plants equals one good handful to 4 plants; 30 lb. per 1,000 plants equals one good handful to 6 plants.)

Method of Applying Fertilizer.

The pineapple crop is fertilized by hand on practically all plantations and galvanised buckets are useful for carrying it along the rows. The fertilizer should be applied from a height of about 6 inches above the ground with a flick of the wrist, which will throw most of the mixture into the base leaves and a smaller amount on the ground close to the base of the plant. When fertilizing tops and small slips, the lower leaves should be lifted by a light pressure from the back of the hand and the fertilizer placed at the base of the small plants on the higher side of the plant.

Care must be taken in fertilizing, as faulty application may bring it in contact with the growing point of the plant and cause serious burning to the young leaves. Fertilizing on a windy day should be

avoided, for excessive amounts of the mixture may settle on the leaves and injure them.

Trace Element Deficiencies.

On many of the sandy soils in Near North Coast districts, a peculiar disorder known as "crookneck" has been noted in young pineapple plants since 1934. The leaves become very narrow, thickly waxed and light green to yellow in colour. During autumn, the centre leaves bunch and bend over almost parallel to the ground. The disorder is now known to be caused by deficiencies of the trace elements copper and zinc.

"Crookneck" can be controlled effectively by applying a 10-6-10 fertilizer to which copper sulphate and zinc sulphate have been added. Fertilizers of this type are now marketed and contain 56 lb. of copper sulphate and 56 lb. of zinc sulphate in each ton of the 10-6-10 mixture. This special mixture is applied in the usual way and has been a standard recommendation for several years as the correct dressing for young pineapple crops, particularly in the Beerwah-Caboolture-Wamuran district.

One application of the 10-6-10 plus copper and zinc mixture to the young plants should normally prevent the development of "crookneck" throughout the whole cropping cycle. However, should the disorder appear after the first year, a spot application to the affected plants will remedy the trouble. If it is necessary to apply the 10-6-10 plus copper and zinc mixture to ratoon crops, the fertilizer should be placed close to the base of the parent plant rather than in the basal leaves. High applications may cause severe injury.

There is some field evidence that the pineapple fertilizers now available burn the plants more than in pre-war days. Therefore, great care should be exercised in using the 10-6-10 plus copper and zinc mixture, which is not as safe as the normal 10-6-10 fertilizer.

Hormones and Flowering in Pineapples.

H. M. GROSZMANN, Horticulturist.

FOLLOWING reports from Hawaii and elsewhere on the use of hormones in pineapple culture, it was decided to test some of them under Queensland conditions and trials were begun late in 1947.

The first point to be determined was the possible value of these substances for the promotion of flowering in the pineapple crop. Several were tested under field conditions and compared with the acetylene treatment which is normally used in commercial practice to induce flowering. One of the hormones, alpha naphthalene acetic acid, was found to be quite effective. When used in spring and early summer, it induced flowering as well as did the acetylene treatment and also gave an increase in fruit weight of 7-14 per cent. When used in autumn, however, alpha naphthalene acetic acid was less reliable than the acetylene, which itself gives variable results in southern Queensland at that time of the year. It is proposed to examine this point further. Meanwhile, alpha naphthalene acetic acid might well be used in place of acetylene during the spring and early summer months.

Alpha Naphthalene Acetic Acid.

Alpha naphthalene acetic acid is now marketed by several firms, under various trade names, in tablet, powder and liquid form. This chemical is first mixed with water to give a solution of the desired

strength, which is then poured into the heart of the plant, allowing rather less than two fluid ounces to each plant. One gallon of the solution will thus treat nearly 100 plants.

For spring and early summer application, a concentration of five parts of alpha naphthalene acetic acid in one million parts of water should be used. In autumn, when the heart of the plant is often filled with water, double this strength is advisable. It will usually be possible to work out the necessary strength from the directions supplied on the labelled container. As a rough guide, however, it has been found in practice that one tablet or one eight-ounce bottle in 100 gallons of water generally gives a concentration of 10 parts in a million.

This very dilute solution is prepared by first thoroughly mixing the hormone with a small quantity of water and then adding the concentrate to the balance of the water required to give the desired strength.

Advantages of Flower Induction.

The use of hormones or acetylene to induce flowering helps the pineapple grower to control the crop on his plantation. In combination with judicious planting, it enables him to avoid glut periods, to spread the crop to suit his convenience in harvesting, and also to ensure that as little fruit as possible matures during the winter period when black heart is prevalent.

When properly applied, flower induction treatment is also useful in preventing "holding over." In an area of well-grown plants, only a small percentage may flower in September, although all are large enough to bear commercial fruit; the rest "hold over" until the next peak period of flowering in March. Sometimes, a few plants do not flower until the following September. Not only is the development of the ratoons delayed by irregular flowering, but the patch becomes uneven and the "hold over" plants become very tall, sucker high, and often collapse when fruiting. This can be prevented by applying either the hormone or acetylene treatment during October and early November to any sizeable plants which have failed to flower in September. The flowers appear about seven weeks after treatment, and the fruit should mature during late April and May.

Treatment in March is used in southern Queensland to bring in fruit in November and December, but the results are uncertain; and unless the situation is warm and otherwise favourable for growth, the fruit is often inferior in quality. In North Queensland, April treatment is practised widely to bring in a November-December crop.

Other Uses of Hormones in Pineapples.

Promotion of flowering is only one of the possible uses of hormones in pineapple culture. The variety of these growth substances, their different effects on the plant, and the distinctive reaction of the plant to one hormone according to the time of application and concentration at which it is used give promise of still greater control of plant and fruit development. One such possibility is indicated by two trials in which concentrated sprays of alpha naphthalene acetic acid were applied to the plant and fruit several weeks before the normal time of fruit maturity. In these trials, fruit maturity was delayed and the size of the fruit increased.

1950 SHOW DATES.

February.

Stanthorpe	1, 2 and 3
Killarney	6 and 7
Warwick	8, 9, 10 and 11
Allora	17 and 18
Clifton	24 and 25
Millmerran	28 and 1st March

March.

Oakey	3 and 4
Pittsworth	7 and 8
Inglewood	10 and 11
Cooyar	11
Goombungee	15
Toowoomba	18 to 23
Jandowae	27 and 28
Dalby	30, 31 and 1st April

April.

Tara	4 and 5
Blackbutt	13, 14 and 15
Chinchilla	13, 14 and 15
Miles	17 and 18
Monto	26 and 27
Taroom	26, 27 and 28

May.

Eidsvold	1 and 2
Roma	2, 3 and 4
Kingaroy	4, 5 and 6
Beaudesert	5 and 6
Marburg	12 and 13
Ipswich	16, 17 and 18
Blackall	16 and 17
Charleville	17 and 18
Biggenden	18 and 19
Thangool	19 and 20
Warrill View	20
Biloela	25 and 26
Gympie	25, 26 and 27
Crow's Nest	26 and 27
Kalbar	27

June.

Maryborough	1, 2 and 3
Wowan	1, 2 and 3
Boonah	2 and 3
Childers	5 and 6
Bundaberg	8, 9 and 10
Mt. Morgan	8, 9 and 10
Lowood	9, 10 and 12

PLANT PROTECTION

Approved Strawberry Planting Material.

A SCHEME for providing approved strawberry runners was initiated in 1947 with a view to reducing the incidence of strawberry virus diseases and improving the general quality of strawberry planting material. In 1949 a number of growers in various districts submitted their crops for examination and a series of inspections were made during the season to ascertain that the crops were kept free of virus infected plants, and were maintained in good cultural condition.

The crops of the following growers have satisfied the requirements of the strawberry-runner scheme and these growers may now sell their runners as "Approved by the Department of Agriculture and Stock." In future years it will be necessary for growers desiring to have their strawberry crops approved to plant runners from approved runner beds.

Grower.	Address.	Variety.
L. H. Keating	Pinklands, *via* Cleveland	Phenomenal
C. A. Kempnich	Pinklands, *via* Cleveland	Phenomenal
G. E. Lax	Redland Bay road, Pinklands, *via* Cleveland	Phenomenal
A. H. Pateman	Pinklands, *via* Cleveland	Phenomenal
J. R. Richardson	Pinklands, *via* Cleveland	Phenomenal
D. J. Brown	Wellington street, Cleveland	Phenomenal
E. H. Lambley	Birkdale	Phenomenal
G. L. Langford	"Springlands," Slacks Creek	Phenomenal and Usher
J. De Meio	"Kingston Park," Woodridge	Phenomenal
W. J. J. Akers	School road, Eight Mile Plains	Phenomenal
J. B. McLaughlin	Logan road, Upper Mount Gravatt	Phenomenal
J. D. Johnston	Glasshouse Mountains	Aurie
G. A. Armstrong	Montville road, Palmwoods	Phenomenal
J. F. Yesberg	Palmwoods	Phenomenal
C. L. Tompkins	Old Bowling Green road, Palmwoods	Rex
W. Smith	Western road, Montville	Aurie and Phenomenal
W. A. Wood	Image Flat road, Nambour	Phenomenal

A Useful Machine for Spraying Potatoes.

W. G. STEELE, Senior Adviser in Agriculture.

WITH the advent of DDT and its successful use in controlling potato tuber moth in the field, potato growers have become interested in the practical application of DDT sprays to potato crops. A primary need was a cheaply constructed spraying machine of horse-drawn type to supplement the manually operated knapsack spray pump commonly used for such purpose.

An outline of the type of machine required was given to a local machinery manufacturer at Boonah and, after some experimenting, a machine of simple construction was produced. This was reasonably priced and gave a satisfactory performance. Spraying four rows at a

Plate 48.
VIEW OF POTATO SPRAYING MACHINE READY FOR OPERATION.

time, a maximum rate of 50 gallons per acre can be applied to give a good cover to the plants. The machine can also be used to spray other crops, such as pumpkins and lucerne.

The machine (Plates 48 and 49), which is drawn by a single horse, consists of a 44-gallon drum fitted to a frame mounted on two wheels each 27 inches in diameter. From the rear of the drum a ¾-inch galvanised iron pipe leads to a brass rotary pump which forces the spraying liquid through to a spray boom fitted with cyclone type nozzles. A shut-off tap is fitted in the line before entering the pump and a gauze strainer is also included. By connecting the pump and boom by means

of a length of rubber hosing, allowance is made for the boom to be raised or lowered on the supporting standards to suit any height of crop.

The pump is rotated by means of a gear wheel, fitted to one of the land wheels, which drives a smaller cog on a counter shaft. From this shaft the drive is taken by means of a rubber V belt and pulleys on to the pump shaft. At ordinary cultivating speed the pump is estimated to make 300 to 350 r.p.m. This gives a fine mist which covers the plants

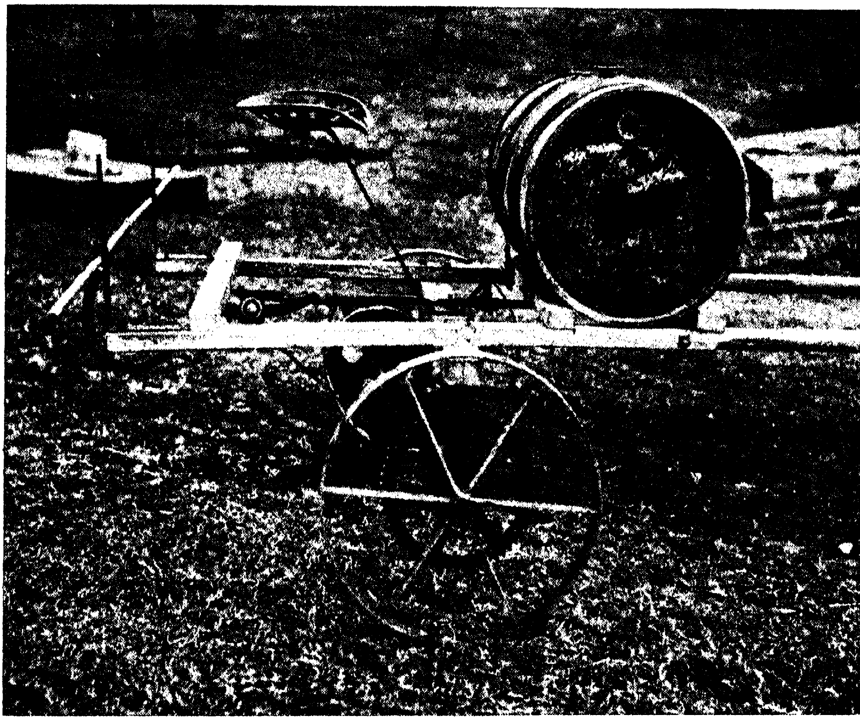


Plate 49.
CLOSE VIEW OF PUMPING MECHANISM.

well. Three spray nozzles, spaced 8 inches apart, are fitted above each row; these may be screwed out if desired and replaced by small bolts so that one or two nozzles only are operating per row. This permits a saving of material if small plants are being sprayed. The span of the land wheels can be altered so as to allow for row widths of 27 to 33 inches.

Up to the present about 10 of these machines have been placed on farms throughout the Fassifern, Charlwood and Aratula areas, and more have been ordered. In some localities growers have purchased a machine on a group basis so that several farms are served by the one machine.

Wool and its Structure.

G. R. MOULE, Director of Sheep Husbandry.

IT is universally acknowledged that wool is one of the most versatile of all fibres, and this is largely due to its unique physical and chemical structure. A close study has been made of the physical structure of wool during the last 100 years, and some of its unique properties as a textile fibre can now be explained. Various authorities have been consulted in compiling this and subsequent articles on the structure of wool; these will be acknowledged at the conclusion of the series.

THE PHYSICAL STRUCTURE OF WOOL.

When a staple of wool is examined by a classer he notes its length, its colour, and its crimping. In addition, he feels it for ''handle'' and tests it for tensile strength. These physical characters of length, colour, crimp, handle, and tensile strength have an important bearing on the uses to which wool is put, though other factors, such as the presence or absence of grass seed and occurrence of dust, also have a bearing on the ''line'' in which any fleece is offered for sale. However, the obvious physical characters such as crimp and tensile strength bear an important relationship to the internal structure of the fibre, and up to a point they may be regarded as being indicative of the arrangement of cells and molecules which are too small to be seen.

Most people who handle wool imagine each fibre is made up of an outer scale sheath and an inner cortex. That a wool fibre is covered by ''scales'' is a common belief, but recent investigations have cast doubt as to whether scales, as such, do exist. The outer sheath of a wool fibre is about $\frac{1}{254000}$ of an inch thick, but it seems to be impossible to remove the scales singly from a fibre in the same way that scales can be removed from a fish. This has led to the suggestion that the scale sheath may not carry scales at all, but that it embodies a number of folds in its outer surface, thereby producing the illusion of scales. However, this folded outer sheath is specific to animal fibres, such as wool, though it is absent from hair, vegetable fibres, and synthetics.

A wool fibre has been likened to a pile of flower pots, all of the same size, which are standing one inside the other (Plate 50). It is important to remember that the folds all lie in the same direction, which is from base to tip. This gives a unidirectional frictional effect,

which is familiar to most people who have drawn their fingers from the base to the tip of a staple and have then done the same thing in the reverse direction. This unidirectional frictional effect probably explains why wool fibres "migrate" after they have been woven into a fabric.

Plate 50.

Plate 51.

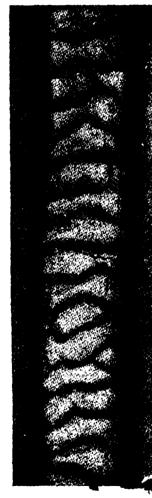


Plate 52.

EXPLANATION OF PLATES.

Plate 50.

WOOL FIBRE (MAGNIFIED). (From "The Book of Wool.")

Plate 51.

PHOTO-MICROGRAPH OF THE MERINO WOOL FIBRE. (After A. F. Barker, in "The Textile Manufacturer.")

Plate 52.

PHOTO-MICROGRAPH OF SOUTHDOWN WOOL FIBRE. (After A. F. Barker, in "The Textile Manufacturer.")

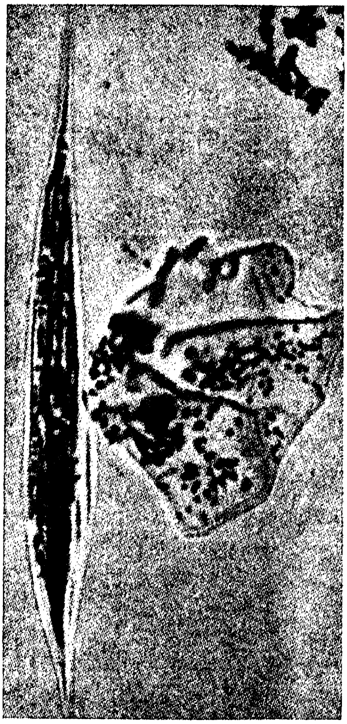
The exposed edge of the folds seems to be set at a definite angle, which is fairly constant for each type of fibre (Plates 51 and 52.) For instance, a certain relationship exists between the visible height of the fold (above the line of the edge of the fibre) and the average diameter of a wool fibre. This relationship for wool is entirely different from that which exists for mohair.

If d be taken to represent the average diameter of any wool fibre and S the average distance between folds (*i.e.*, the length of the apparent scales), the formula $\frac{S}{d}$ is useful for comparing different fibres. In the case of Merino wool, the ratio ranges from 0.4 upwards, while Southdown wool has a $\frac{S}{d}$ ratio of 0.16 to 0.39. The following table gives the range of the $\frac{S}{d}$ ratio of four different wool types:—

Fibre.	$\frac{S}{d}$ *Ratio.*
Merino wool—finest	1.00
Merino wool—60's	0.55
Southdown	0.27
Low quality wool	0.11

This table is of vital interest because comparison between low quality "Down" wool and the finest Merino wool suggests that the rate of growth of the scale sheath in comparison with the solid inner core or cortex is much quicker in the case of Downs wool and is only lightly overgrown in the case of the Merino.

The folds are extremely small and in a "64" Merino wool there may be as many as 50,000 to 60,000 per inch. They have an important bearing on the way in which the wool reflects light and so influence to some extent the colour of a fleece and the dyeing capacity of a fabric.



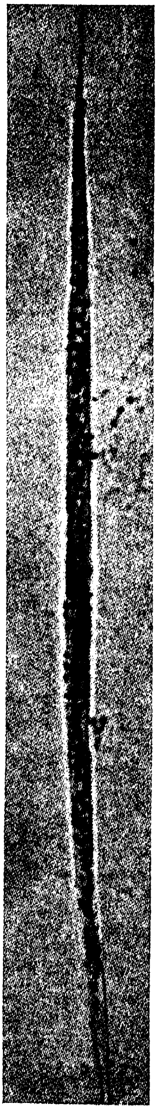


Plate 53 (above).
SPINDLE CELL OF NORMAL LENGTH, GREATLY MAGNIFIED. (After E. H. Mercer.)

Plate 54 (at right).
STRETCHED SPINDLE CELL, GREATLY MAGNIFIED. (After E. H. Mercer.)

These facts should also be kept in mind when considering the handle of wool, although other factors such as fibre diameter and resilience also influence this important quality. Minute spaces or pores exist between the folds in the outer sheath; in a dry fibre they might be as small as 0.06 micron (a micron is about 1/25,000 inch) but they expand up to 0.4 micron when the fibre is wet. The importance of this to the dyer is obvious. The expanded pores allow the dye to enter much more easily and when the fibre dries the pore contracts and locks the dye in under the cuticle sheath, as the outer folded layer of so-called scales is more correctly known.

The inner layer or cortex of the wool fibre consists of a solid matrix. This is an important point differentiating wool from hair, which has a hollow medulla in the centre of the fibre.

Plate 55.
Spindle Cells from Fine Merino Wool. (After E. H. Mercer.)

There are two distinct parts to the cortex, the more important and spectacular being the spindle cells (Plates 53, 54, and 55). These are elongated, have tapering ends, and are capable of tremendous extension. It is possible to free them from the fibre and stretch them many times their unexpanded length. Besides being extensible within themselves, the spindle cells are arranged on a slight bevel. It is well known that by increasing the bevel and allowing cards to slip along one another the length of the stack can be increased.

When a wool fibre is stretched, the spindle cells first elongate and then they slip along one another until their contact is destroyed. During this time the folded sheath expands until it reaches its limits and it, too, finally breaks. This gives wool a particular extension curve of the type shown in Plate 56.

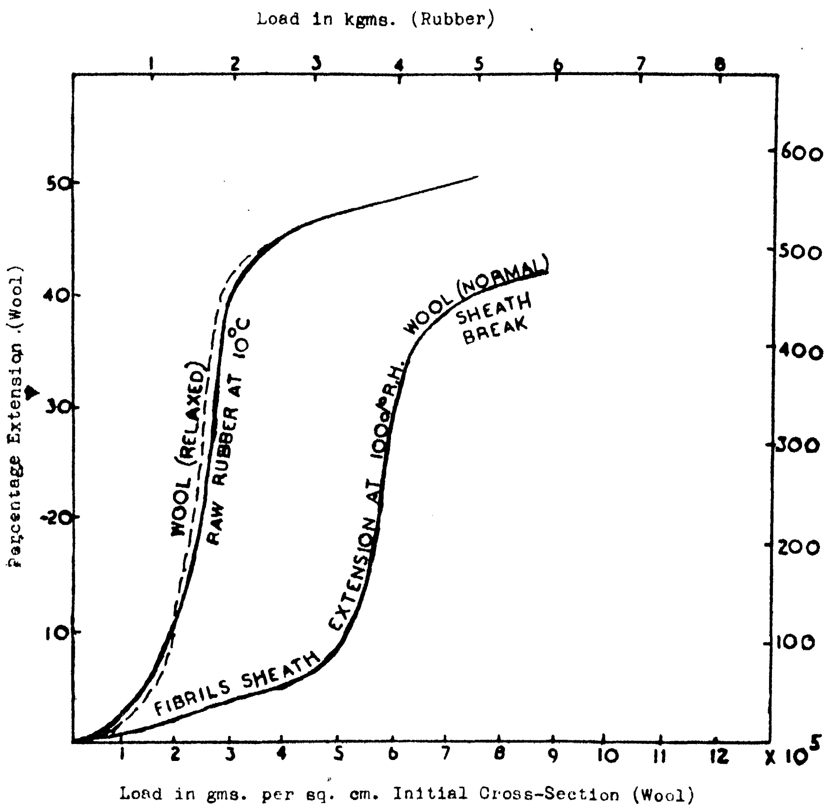


Plate 56.

GRAPH SHOWING EXTENSION OF WOOL FIBRE AND RAW RUBBER.

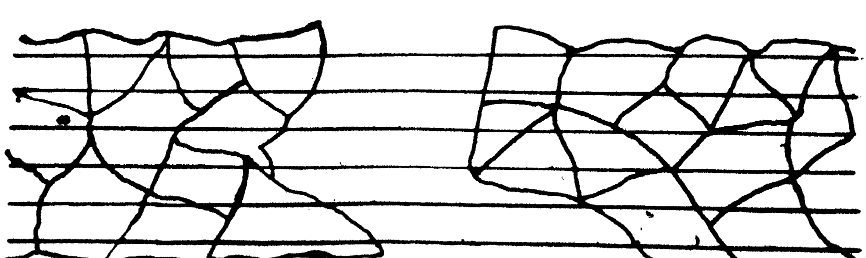


Plate 57.

DIAGRAM OF A BROKEN SHEATH EXPOSING CENTRAL FIBRILS. (After A. F. Barker, in "The Textile Manufacturer.")

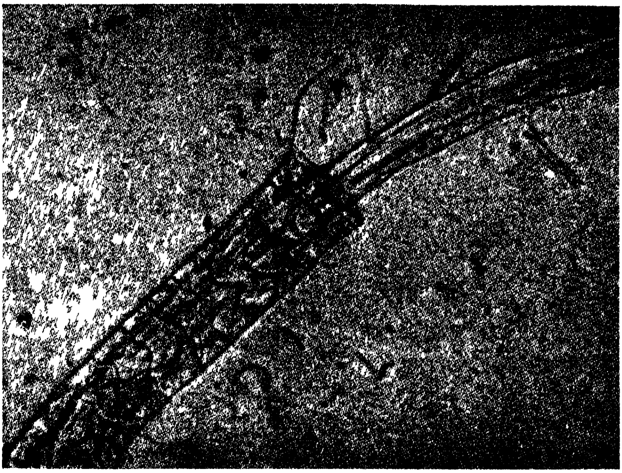


Plate 58.
SHEATH AND CENTRAL FIBRILS OF THE NORMAL WOOL FIBRE. (After A. F. Barker, in "The Textile Manufacturer.")

The other part of the cortex consists of fibrils which are tightly packed together (Plates 57 and 58). This means that the wool fibre is a solid structure (Plate 59) and this is one of the important differentiating features between wool and hair. Hair has a hollow medulla which contains air, and this alters its dyeing capacity.

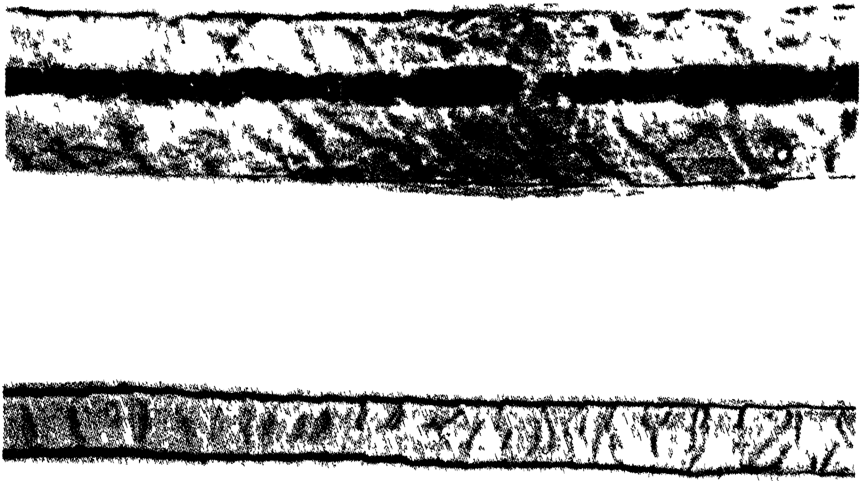


Plate 59.
COARSE AND FINE FIBRES (MAGNIFIED). (From "The Book of Wool.")

THE CHEMICAL COMPOSITION AND STRUCTURE OF WOOL.

Chemically, wool is composed of a particular protein known as keratin. The building blocks from which wool protein is made are known as amino acids and at least 13 are of importance in the formation of wool protein. When combined in the fibre they constitute chains, which are referred to as peptide chains, and they are folded in a fashion suggested in Plate 60.

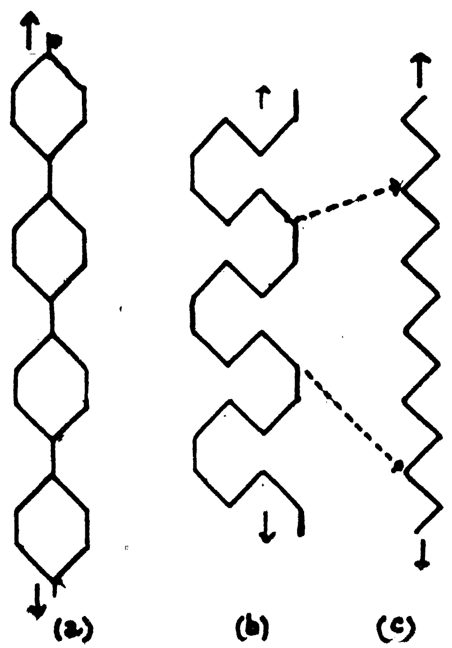


Plate 60.

DIAGRAM OF SMALL PORTIONS OF CHAIN MOLECULES. (*a*) Cellulose; (*b*) Wool before stretching; (*c*) Wool stretched. The long-range elasticity made possible by the structure of the wool molecule distinguishes the natural fibre from many artificial products, especially those based on cellulose. (After McMahon.)

Further folding is opposed by chemical linkages between the chains, but these can be broken on boiling and this allows the folding to increase. In this way shrinkage of the fibre occurs.

Wool keratin is extremely resistant to the action of water, soaps, and inorganic solvents, such as sulphuric acid. This allows wool to be scoured and "carbonised" to remove dust and grass seeds and burrs moderately easily. The sulphur content of wool protein is high, and it occurs mainly in the amino acid cystine, which is one of the special building blocks from which wool protein is made. The sulphur plays an important role, as it closes the link in the chemical chain which constitutes wool. However, this link is very susceptible to damage by intense heat and when this vulnerable point is attacked "wasty tip" may develop. This condition is well known to most sheepmen in north-western and central-western Queensland, who have examined many "backs."

Crop Planting Tables—Southern Districts.

Showing Times of Planting and Rates of Sowing for Field Crops.

BY OFFICERS OF THE AGRICULTURE BRANCH.

QUEENSLAND is a large State covering a wide range of climatic conditions, and in a crop planting summary it is impossible to define accurately planting and harvesting times for each and every area. The tables which have been compiled for the various agricultural areas are intended to be a general guide with reference to the season generally experienced, and in determining sowing times attention has been paid to the seasonal conditions under which it is expected harvesting would be carried out.

Zones.

For the purposes of the tables, Queensland has been divided into three main zones as follows:—

Southern Districts.—Included in this zone is the area south of latitude 25° (approximately Bundaberg) to the southern border of Queensland.

Central Districts.—This zone lies between latitude 20° (approximately Bowen) and latitude 25°.

Northern Districts.—All districts north of latitude 20° are grouped in this zone.

The Coastal Districts within each zone refer, for the most part, to the land between the main coastal ranges and the seashore—approximately a 30-mile strip. In some areas, where the influence of coastal rainfall extends further inland, this strip may be wider. The Inland Districts are defined as beyond that limit to the outer edge of the 25-inch annual rainfall belt. Tableland Districts refer to elevated areas within about 100 miles of the coast.

Generally speaking the bulk of the annual rainfall in Queensland is received during the summer months. In areas with an annual rainfall lower than 25 inches and with a high rate of evaporation of soil moisture, crop production is hazardous without supplementary irrigation.

Explanation of Terms.

The meaning of most terms used in the tables is obvious, and the only ones in which confusion in interpretation may arise are "green feed" and "food."

The term *green feed* is used where the crop can be cut and fed immediately in the green state to farm animals. The term *food* is used where the crop can be harvested and fed immediately to farm animals, or held in good condition for some time in the field without harvesting if required, or harvested and then stored in farm structures.

It is recognised that individual farmers may use some crops in other ways than indicated in the tables, but the intention here is to name the *main purposes* for which various crops are used.

SOUTHERN DISTRICTS.

SOWING AND PLANTING TABLE FOR FIELD CROPS.

(This Table requires to be adapted to suit individual circumstances).

Crop.	Main Purpose for Which Grown.	When to Sow or Plant. Coastal Districts.	When to Sow or Plant. Tableland Districts.	When to Sow or Plant. Inland Districts.	How Sown or Planted. Distance Rows Apart.	How Sown or Planted. Distance Between Plants.	How Sown or Planted. Quantity of Seed per acre if Drilled.	How Sown or Planted. Quantity of Seed per acre if Broadcast.	Approximate Period of Growth of Crop in Months.	Remarks.
					Ft. In.	Ft. In.				
Arrowroot	Flour and pig food..	Aug. to Oct.	..	..	5 0	2 0	10 to 12 cwt. of bulbs	..	8 to 10 ..	Suited best to coastal districts
Artichoke	Pig food	Aug. to Nov.	Sep. to Nov.	..	3 6	1 6	4 to 5 cwt. of tubers	..	4 to 5 ..	Difficult to store; will keep better in the soil
Barley (Cape and Skinless)	Grazing and green feed	Mar. to June	Mar. to July	Mar. to June	Drilled	..	1 bus. ..	1½ bus. ..	2 to 4 ..	..
Barley (Malting) ..	Grain	..	May and June	May and June	Drilled	..	1 bus. ..	1½ bus. ..	4½ to 5 ..	..
Beans, Lima ..	Seed	Sep. to Dec.	Oct. to Dec.	Oct. to Dec.	2 6	0 9	20 to 25 lb.	..	3½ to 4 ..	..
Beans, Navy or Canning	Seed	Sep. to Jan.	Sept. to Jan.	Sep. to Jan.	2 4	0 4	15 to 24 lb.	..	3 to 3½ ..	Wider rows for fertile soils
Beet, Silver	Green feed for poultry	Mar. to June	Mar. to June	Mar. to June	2 6	1 0	4 lb. ..	..	3 to 4 ..	..
Broom Millet ..	Brushware	Sep. to Dec.	Oct. to Dec.	Oct. to Dec.	3 6	0 9	3 to 4 lb. ..	..	4½ to 5 ..	..
Buckwheat	Nectar for bees; grain for poultry	Sep. to Mar.	Sep. to Mar.	Sep. to Feb.	2 0	0 3	25 to 30 lb.	40 to 45 lb.	1½ to 2½	Produces a valuable nectar crop within 6 to 7 weeks of planting
Cabbage	Green feed	All seasons except summer	All seasons except summer	All seasons except summer	2 6	2 0	1 lb. ..	..	4 to 5 ..	..
Canary Seed ..	Hay, green feed and grain	..	Apr. to June	Apr. to June	Drilled	..	10–15 lb. ..	20–25 lb. ..	4½ to 5	..
Carrot, Field ..	Stock food	Mar. to June	Apr. to May	Apr. to May	1 9	..	2 to 3 lb. ..	..	4 to 5 ..	..
Cassava	Pig food	Aug. to Oct.	..	..	5 0	2 0	Cuttings used	..	8 to 10 ..	Boil tubers before using; discard water
Cotton	Fibre..	Sep. to Dec.	Oct. to Dec.	Oct. to Dec.	3 6	1 6	15 to 20 lb. delinted seed	..	5 to 7 ..	..

Cow Cane	Stock food	Sep. to Dec.	Sep. to Dec.	..	5 0	1 6	2 or 3-eyed setts used	..	7 to 9	Suitable for several ratoons
Cowpea*	Seed, grazing and hay	Sep. to Jan.	Oct. to Jan.	Oct. to Jan.	3 0	0 6	6 to 10 lb.	15 to 20 lb.	3½ to 4½	For green manure purposes, *see* under "Leguminous cover crops"
Garlic	Market	Aug. to Sep.	Aug. to Sep.	..	1 6	0 6	..	..	6 ..	..
Grasses (*see* "Pastures")										
Kale	Stock food	Feb. to June	Feb. to June	Feb. to June	3 0	2 0	1 lb. ..	2 lb. ..	4 ..	..
Kohl Rabi	Stock food	Mar. to Apr.	Mar. to Apr.	Mar. to Apr.	2 6	1 6	2 lb. ..	..	4 to 5 ..	..
Leguminous Cover Crops*—										
Blue Lupin ..	Green manure ..	Autumn ..	Autumn ..	Autumn ..	Drilled	..	1 bus. ..	1½ bus. ..	5 ..	Erect growth
Cowpeas	Green manure ..	Summer ..	Summer ..	Summer ..	Drilled	..	20–25 lb. ..	25–30 lb. ..	3½ to 5 ..	Creeping growth
Cusara Pea ..	Green manure ..	Summer ..	Summer ..	Summer ..	Drilled	..	5 lb. ..	10 lb. ..	5 to 6 ..	Erect growth
Field Pea	Green manure ..	Autumn ..	Autumn ..	Autumn ..	Drilled	..	1 to 1½ bus.	1½ to 2 bus.	3 to 4 ..	Creeping growth
Gambia Pea ..	Green manure ..	Summer ..	Summer ..	Summer ..	Drilled	..	5 lb. ..	10 lb. ..	5 to 6 ..	Erect growth
Mauritius (Velvet) Bean	Green manure ..	Summer ..	Summer ..	Summer ..	3 0	2 0	20 lb. ..	40 to 60 lb.	5 ..	Creeping growth
Poona Pea	Green manure ..	Summer ..	Summer ..	Summer ..	Drilled	..	20 to 25 lb.	20 to 30 lb.	3½ to 4 ..	Erect growth
Rice Bean ..	Green manure ..	Summer ..	Summer ..	Summer ..	Drilled	..	15 to 20 lb.	20 to 25 lb.	4 to 5 ..	Creeping growth
Soybean	Green manure ..	Summer ..	Summer ..	Summer ..	Drilled	..	20–30 lb. ..	25–35 lb. ..	3 to 4 ..	Semi-erect growth
Tangier Pea ..	Green manure ..	Autumn ..	Autumn ..	Autumn ..	Drilled	..	10 lb. ..	12 lb. ..	5 ..	Creeping growth
Vetches or Tares ..	Green manure ..	Autumn ..	Autumn ..	Autumn ..	Drilled	..	¾ bus. ..	1 bus. ..	3½ to 4½	Creeping growth
Linseed (Flax) ..	Seed for oil	Apr. to June	Apr. to June	Apr. to June	Drilled	..	20 to 25 lb.	..	4½ to 5 ..	..
Lucerne*	Hay and grazing ..	Apr. to May	Apr. to May	Apr. to May	Drilled	..	10 to 12 lb.	14 to 18 lb.	3 ..	For grazing in drier areas 4 to 6 lb. In grass mixtures 1 to 3 lb.
Maize	Grain and stock food	Aug. to Jan.	Sep. to Jan.	Sep. to Jan.	4 0	1 3	8 to 10 ..	56 lb. for stock food	4 to 5 .. For stock food 3 to 4	For stock food, closer row and plant spacing increased seed rate
Pop Corn	Grain	Sep. to Jan.	Oct. to Jan.	Oct. to Jan.	3 6	1 0	5 to 7 lb. ..	..	4	..
Sweet Corn ..	Market	Sep. to Jan.	Oct. to Jan.	Oct. to Jan.	3 6	1 0	6 to 8 lb. ..	..	3	..
Mangel and Sugar Beet	Stock Food	Feb. to May	Mar. to June	Mar. to June	2 6	1 0	4 to 6 lb. ..	..	6 to 7	..

* The use of bacterial inoculum with most leguminous plants is recommended. Supplies are obtainable from the Department of Agriculture and Stock, Brisbane.

SOUTHERN DISTRICTS.—*continued.*

SOWING AND PLANTING TABLE FOR FIELD CROPS.

(This Table requires to be adapted to suit individual circumstances).

Crop.	Main Purpose for Which Grown.	When to Sow or Plant.			How Sown or Planted.				Approximate Period of Growth of Crop in Months.	Remarks.
		Coastal Districts.	Tableland Districts.	Inland Districts.	Distance Rows Apart.	Distance Between Plants.	Quantity of Seed per acre if Drilled.	Quantity of Seed per acre if Broadcast.		
					Ft. In.	Ft. In.				
Millet (French) ..	Grain	Sep. to Jan.	Oct. to Jan.	Oct. to Jan.	Drilled	..	10 to 14 lb...	20 lb.	2 to 2½	..
Millet (Giant and Dwarf Setaria)	Grain, hay and grazing	Aug. to Feb.	Sep. to Feb.	Sep. to Feb.	Drilled	..	10 to 14 lb. ..	20 lb.	2½ to 3	Can be grazed earlier if required
Millet (Japanese) ..	Hay and grazing ..	Aug. to Feb.	Sep. to Feb.	Sep. to Feb.	Drilled	..	10 to 14 lb. ..	20 lb.	2 to 3	Can be grazed earlier if required
Millet (White Panicum)	Hay and grazing ..	Aug. to Feb.	Sep. to Feb.	Sep. to Feb.	Drilled	..	10 to 14 lb. ..	20 lb.	2½ to 3	Can be grazed earlier if required
Oats	Grazing, hay and grain	Mar. to June	Feb. to June	Feb. to June	Drilled	..	1½ bus. ..	1½ to 2 bus.	3 to 5 ..	..
Onion	Market	Apr. to May	Mar. to Apr.	Mar. to Apr.	1 2	3 to 6 in.	1½ to 3 lb.	..	5 to 6 ..	..
Panicums (*see* "Millets") ..										
Pasture Grasses—										
Blue Panic ..	Pasture	Sep. to Feb.	Sep. to Feb.	Sep. to Feb.	..	..	..	4 lb. ..	Perennial; summer grower	To be grazed heavily and intermittently once established
Buffel	Pasture	Sep. to Feb.	Sep. to Feb.	Sep. to Feb.	..	..	..	4 to 5 lb. ..	Perennial; summer grower	Sandy or deep soils best; lighter sowing rate in the west on sandy country
Cocksfoot	Pasture	..	Autumn ..	..	..	..	..	15 to 20 lb.	Perennial	Intermittent grazing spring and early summer
Couch (Green) ..	Pasture	Sep. to Feb.	Sep. to Feb.	..	..	..	..	5 to 8 lb. ..	Perennial; summer grower	Pest in cultivation
Elephant	Pasture and green feed	Sep. to Jan.	Oct. to Feb.	Oct. to Feb.	5 0	2 0	Root and stem cuttings used	..	Perennial; summer grower	Graze or cut frequently to prevent woody stems developing; ratoons vigorously
Guinea (Common and Green Panic)	Pasture	Sep. to Mar.	Oct. to Feb.	Oct. to Feb.	3 0	3 0	Root cuttings used for Common Guinea	4 to 5 lb. ..	Perennial; summer grower	Graze to maintain young growth, but allow resting period
Italian Rye ..	Pasture	Mar. to Apr.	Mar. to Apr.	..	Drilled	..	15 lb. ..	15 to 20 lb.	Annual ..	Intermittent winter and spring grazing

Kikuyu	Pasture	Sep. to Feb.	Sep. to Feb.	Sep. to Feb.	3 0	3 0	Runner cuttings used, or plough or disc in chopped runners	..	Perennial; summer grower	27″ rainfall lowest limit for growth; useful for pig paddocks
Mitchell	Pasture	..	..	Spring-early summer rains	..	..	..	2 to 3 lb. ..	Perennial; summer grower	Trample seed in with sheep
Molasses	Pasture	Sep. to Feb.	Oct. to Feb.	..	..	..	..	2 to 4 lb. ..	Perennial; summer grower	Used on scrub burns; needs careful grazing; suitable only in limited areas; frost susceptible
Para	Pasture	Sep. to Feb.	..	..	6 0	6 0	Runner cuttings used, or plough or disc in chopped runners	3 to 4 lb. ..	Perennial; summer grower	Use in swamps or where water supply ample or land always damp
Paspalum	Pasture	Sep. to Feb.	Oct. to Feb.	..	..	..	..	8 to 12 lb.	Perennial; summer grower	Best growth where rainfall exceeds 40″
Perennial Rye ..	Pasture	Mar. to Apr.	Mar. to Apr.	..	..	..	..	15 to 20 lb.	Perennial; winter grower	Limited use in specially favoured areas
Prairie	Pasture	Mar. to Apr.	Mar. to Apr.	..	..	..	..	20 to 25 lb.	Annual; winter and spring grower	May regenerate if allowed to seed
Rhodes	Pasture and hay ..	Sep. to Feb.	Oct. to Feb.	Oct. to Feb.	..	..	..	8 to 12 lb.	Perennial; summer grower	Sown on summer burns; best results from sowing in prolonged showery weather
Toowoomba Canary	Pasture	..	Mar. to Apr.	..	..	..	4 lb. ..	..	Perennial; winter and spring grower	Very light grazing in first year and then intermittently
Water Couch ..	Pasture	Summer ..	..	..	..	..	Runners used, or plough or disc in chopped runners	..	Perennial; summer grower	Frost susceptible; can be used to stabilise dam banks
Pasture Legumes*— Alsike Clover ..	Pasture mixtures ..	Autumn ..	Autumn ..	..	..	..	..	1 lb. in mixtures	Annual in Queensland; winter and spring grower	Moist winter conditions are required
Berseem Clover ..	Alone and in pasture mixtures	Late summer	Late summer	Late summer	..	..	..	4–5 lb. in mixtures; 8–10 lb. alone	Annual; autumn and winter grower	Requires 12″ winter rainfall or irrigation

* See footnote on page 103.

SOUTHERN DISTRICTS.—*continued.*

SOWING AND PLANTING TABLE FOR FIELD CROPS.

(This Table requires to be adapted to suit individual circumstances).

Crop.	Main Purpose for Which Grown.	When to Sow or Plant.			How Sown or Planted.				Approximate Period of Growth of Crop in Months.	Remarks.
		Coastal Districts.	Tableland Districts.	Inland Districts.	Distance Rows Apart.	Distance Between Plants.	Quantity of Seed per acre if Drilled.	Quantity of Seed per acre if Broadcast.		
					Ft. In.	Ft. In.				
Black Medic ..	Pasture mixtures ..	Autumn ..	Autumn ..	Autumn ..	..	..	..	2–3 lb. in mixtures	Annual o biennial	Growth extends into summer; may regenerate
Burr Medic ..	Pasture mixtures ..	Autumn ..	Autumn ..	Autumn ..	..	..	..	2 lb. ..	Annual; winter and spring grower	Regenerates; more suitable for Tableland and Inland Districts
Clustered Clover ..	Pasture mixtures ..	Autumn ..	Autumn ..	Autumn ..	..	..	..	2 to 3 lb. ..	Annual; spring grower	Shows drought resistance; regenerates
Phasemy Bean ..	Pasture mixtures ..	Spring-summer	Spring-summer	Spring-summer	..	..	..	5–7 lb. in mixtures	Annual; summer grower	Regenerates; of promise in Rhodes grass country
Red Clover ..	Pasture mixtures ..	Autumn ..	Autumn ..	..	..	..	..	2–3 lb. in mixtures	Short lived perennial; late winter, spring, and early summer grower	..
Strawberry Clover	Pasture mixtures ..	All seasons except winter	All seasons except winter	..	3 0	3 0	Runners used	3 lb. ..	Perennial; spring, early summer grower	Requires ample moisture; very limited experience in Queensland
Subterranean Clover	Pasture mixtures ..	Autumn	Autumn ..	Autumn ..	..	..	..	3 to 5 lb. ..	Annual; winter grower	Requires 12–15" May-October rain with favourable seeding conditions August-September for regeneration
White Clover ..	Pasture mixtures ..	Early autumn	Early autumn	Early autumn	..	..	..	2 lb. in mixtures	Perennial; winter and spring grower	Requires 12" May–October rain for best results
Pea, Field * ..	Stock food and grazing	Mar. to June	Mar. to June	Apr. to June	Drilled	..	1 to 1¼ bus.	1½ to 2 bus.	3 to 4 ..	When sown in combination with a cereal, ½ to ¾ bus. per acre. For green manure purposes, *see* leguminous cover crops

Peanut	Kernels	Sep. to Jan.	Sep. to Dec.	Sep. to Dec.	3 0	1 3	25–30 lb. of kernels	..	4 to 5 ..	..
Potato	Market	Aug. to Feb.	Aug. to Feb.	Aug. to Feb.	2 6	1 0	6–8 cwt. of tubers	..	3 to 4 ..	..
Pumpkin	Market and stock food	Aug. to Jan.	Sep. to Jan.	Sep. to Jan.	8 to 12 ft.	3 to 4 ft.	2 to 3 lb. ..	..	5 to 6 ..	..
Rape	Stock food	Mar. to May	Mar. to May	Mar. to May	Drilled	..	5 to 6 lb. ..	6 to 8 lb. ..	2½ to 4 ..	..
Rice, Swamp ..	Grain	Oct. to Jan.	Oct. to Jan.	Oct. to Jan.	Drilled	..	80 to 120 lb.	..	4 to 5 ..	Requires constant flooding during growing period
Rice, Upland ..	Grain	Oct. to Jan.	Oct. to Jan.	..	Drilled	..	60 to 90 lb.	..	4 to 5 ..	..
Rye	Grain and grazing ..	Mar. to June	Apr. to June	Apr. to June	Drilled	..	¾ to 1 bus...	1 to 1¼ bus.	3 to 5 ..	..
Sorghum, Grain ..	Grain, stubble grazing	Sep. to Feb.	Sep. to Jan.	Sep. to Jan.	14 to 42 in.	..	4 to 12 lb.	12 to 20 lb.	3½ to 5	
Sorghum, Sweet ..	Stock food	Sep. to Feb.	Sep. to Feb.	Sep. to Jan.	3 6	0 4	5 to 6 lb. ..	12–15 lb. ..	3½ to 5	Immature growth of any member of this group may contain poisonous properties, and care should be exercised in grazing
Sudan Grass ..	Grazing and hay ..	Sep. to Feb.	Sep. to Jan.	Sep. to Jan.	Drilled	..	8 to 10 lb.	10 to 14 lb.	2 to 4	
Soybean *	Seed, grazing and hay	Sep. to Jan.	Oct. to Jan.	Oct. to Jan.	2 6	4 to 6 in.	15 to 20 lb.	25 to 35 lb. ..	3½ to 4½	For green manure purposes, *see* under "Leguminous cover crops," page 103
Sunflowers	Seed for oil and bird seed	Sep. to Jan.	Sep. to Jan.	Sep. to Jan.	28 or 35 in.	1 0	4 to 6 lb. ..	..	4 to 5 ..	Wider spacing and less seed per acre where hand harvesting adopted
Sweet Potato ..	Market and stock food	Aug. to Jan.	Sep. to Jan.	Sep. to Jan.	3 to 3½ ft.	1 6	Cuttings used	..	4 to 5 ..	Useful for pig grazing
Tobacco	Leaf	Sep. to Dec.	Sep. to Dec.	Sep. to Dec.	4 0	18 to 24 in.	1–5th oz. in seed-beds	..	3 to 4 .. from transplanting	Plants must be raised in specially prepared seed-beds and transplanted to permanent positions when strong enough
Turnip (including Swede)	Market and stock food	Feb. to May	Feb. to May	Feb. to May	2 0	1 0	1½ to 2 lb.	3 to 4 lb. ..	4 to 5 ..	..
Vetches or Tares * ..	Grazing	Mar. to June	Mar. to June	Mar. to June	Drilled	..	30 to 40 lb.	40 to 60 lb.	3 to 4 ..	For green manure purposes, *see* under "Leguminous cover crops," page 103
Wheat	Grain, grazing and hay	Apr. to June	Apr. to July	Apr. to July	Drilled	..	¾ to 1 bus.	1 to 1¼ bus.	3 to 6 ..	Fodder purposes only on coast, where rust resistant varieties are recommended

* See footnote on page 103.

PRODUCTION RECORDING—*continued.*

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.	Month Compiled.
		Lb.	Lb.		
	AUSTRALIAN ILLAWARRA SHORTHORN—*continued.*				
	JUNIOR, 3 YEARS (STANDARD 270 LB.)—*continued.*				
Beaury Opal 25th	A. F. Campbell, Killarney	6,907·1	286·705	Dulcamah Monash	June
Rhodesview Nancy 75th	V. R. Nugent, Murgon	8,476·3	315·742	Fairvale Major	July
Fernhome Beryl	R. S. Griffiths, Moregatta	6,758·6	300·684	Merravale Gentle's Commodore	July
College Kitty 11th	Q.A.H.S. and College, Lawes	7,223·75	277·157	Alfa Vale Pride 3rd	July
Alfa Vale Model 29th (349 days)	W. H. Thompson, Nanango	17,634·65	846·644	Alfa Vale Paisley	August
Bantry Lila	D. Sullivan, Pittsworth	8,763·15	393·328	Rosenthal Surplus 2nd	August
College Rascal 19th	Q.A.H.S. and College, Lawes	6,897·3	278·688	Alfa Vale Pride 3rd	August
Ripley Park Mossrose 4th (223 days)	I. B. Skerman, Kaimkillenbun	6,748·39	270·6	Glenroy Security	August
Bunyaview Reflection's Rosette	W. D. Davis, Wambo	9,248·0	350·0	Trevor Hill Reflection	September
Cedargrove Ella 9th	F. Derrick, Monto	8,659·0	348·0	Rosenthal Scout	September
Fairvale Doris 13th	W. D. Davis, Wambo	7,221·0	327·0	Fairvale Reward	September
Alfa Vale Florrie 7th	W. H. Thompson, Nanango	8,297·0	380·0	Penrhos Pansy's Pride	October
Rhodesview Royal Primrose 6th	W. Gierke and Sons, Helidon	9,042·0	366·0	Alfa Vale Nigel	October
Fernhome Cecile	R. S. Griffiths, Moregatta	6,554·0	337·0	Glengarry Gem's Royal	October
Alfa Vale Myrtle 6th	W. H. Thompson, Nanango	8,312·0	334·0	Alfa Vale Reward 2nd	October
Grahamville Sapphire	W. J. Horrocks, Maclagan	7,185·0	306·0	White Park Ronald	October
Fairvale Dulcie	I. B. Skerman, Kaimkillenbun	6,119·0	277·0	Fairvale Red Prince	October
	SENIOR, 2 YEARS (STANDARD 250 LB.).				
Glen Idol Daphne 27th	Estate of P. Doherty, Gympie	10,201·8	377·302	Glen Idol Coronet	April
Glen Idol Daphne 29th	Estate of P. Doherty, Gympie	9,765·0	345·095	Glen Idol Charmer	April
Kapleton Maiden	J. A. Lane, Kilcoy	8,132·15	324·829	Rhodesview Royal Lad	April
Hillfield Beauty 2nd	S. J. Lester, Mulgowie	6,222·85	284·15	Blacklands Florrie 9th's Heir	April
Rhodesview Queenie 32nd	W. Gierke and Sons, Helidon	6,534·2	280·252	Rhodesview Royal Lad 2nd	April
Applegarth Calm 12th	R. F. Limberg, Esk	6,444·1	279·713	Fairholm Evidence	April
Glen Idol Countess 8th	Estate of P. Doherty, Gympie	7,720·7	266·502	Glen Idol Charmer	April
Bingleigh Ettie 11th	J. H. Fogg, Toogoolawah	6,918·85	262·525	Bingleigh Jean's Sultan	April
Glenore Cherry	P. J. Donaghy and Son, Malanda	8,539·1	350·7	Alfa Vale Pride 18th	May
Fernhome Lillian	L. Emmerson, Malanda	7,274·1	317·412	Glengarry Gem's Royal	May
Cedar Grove Ellen 35th	F. Derrick, Moonford	7,881·75	307·476	Coral Grange Darby	May
Penrhos Janet 2nd	A. Sandilands, Wildash	6,765·25	269·163	Rosenthal McArthur	May
Alascan Pal	A. Lohse, Biggenden	8,415·9	268·687	Sunnyview Ruby's Elect	May
Fairvale Prince's Doris 12th	I. B. Skerman, Kimkillenbun	6,360·26	257·798	Fairvale Red Prince	May
Cedar Grove Wonder 43rd	F. Derrick, Moonford	7,246·75	253·775	Rosenthal Scout	May
Blacklands Queen 34th	A. Pickels, Proston	8,163·65	251·702	Parkview Alexander	May
Wonga Jessie	J. Coonan, Cambooya	8,349·75	380·586	Fairlie Senator	June
Blacklands Pretty Maid 21st	A. Pickels, Proston	7,763·9	378·204	Blacklands Maiden's Monarch	June
Ardilea Broady 14th	Hinrichsen and Sons, Clifton	6,950·7	284·251	Newstead Musician	June
Yarranvale My Gift	W. D. Davis, Wambo	7,787·25	281·45	Sunnyview Royal National	June
Wamba Evelyn	W. D. Davis, Wambo	6,403·5	275·557	Highfields Captain	June
Beaury Plum 13th	A. F. Campbell, Killarney	6,558·4	255·367	Carribee Aviator	June
Blacklands Foremost 44th	A. Pickels, Proston	11,310·45	450·526	Blacklands Gloucester	July
Wonga Flower	J. Coonan, Cambooya	7,991·65	371·518	Reservior Yenda	July
Wonga Cherry	J. Coonan, Cambooya	8,740·2	367·999	Reservior Yenda	July

College Rapture 9th	Queensland Agricultural High School and College, Lawes	8,302·5	291·888	Alfa Vale Magic	July
Corella Dulcie	Mrs. A. E. Powell, Chinchilla	7,233·0	269·569	Alfa Vale Jumbo	July
Penrhos Pansy 23rd	A. Sandilands, Wildash	6,840·9	264·708	Rosenthal McArthur	July
Learmont Beauty	P. J. Donaghy, Malanda	9,171·35	387·862	Sunnyview Melba's Hero	August
Greenhill Polly 11th	J. A. Lane, Kilcoy	11,609·85	343·721	Coral Grange Darby	August
Bantry Model 2nd	D. Sullivan, Pittsworth	7,554·45	320·878	Valera Monarch	August
College Stately 25th	Queensland Agricultural High School and College, Lawes	8,116·1	271·114	Alfa Vale Pride 3rd	August
College Rapture 10th	Queensland Agricultural High School and College, Lawes	7,452·7	268·56	Alfa Vale Pride 3rd	August
Kulpi Dairymaid	H. L. and C. I. Bruggemann, Kulpi	5,501·63	260·74	White Park Redman	August
Blacklands Envy 48th	G. Sperling, Kooralgin	6,020·8	251·83	Blacklands Topsy's Elect	August
SENIOR, 2 YEARS (STANDARD 250 LB.).					
Cedargrove Ellen 36th	F. Derrick, Moonford	8,475·0	302·0	Rosenthal Scout	September
Calrossie Camelia 2nd	D. L. Lithgow, Jandowae	6,240·0	279·0	Aynesley Eclipse 3rd	September
Alascan Hazel	A. Lohse, Degilbo	7,691·0	319·0	Alfa Vale Review	October
Millievale Doris	A. H. Webster, Helidon	7,003·0	274·0	Corals Gold Standard	October
JUNIOR, 2 YEARS (STANDARD 230 LB.).					
Cedar Valley Honeysuckle	A. C. Marquardt, Mondure	8,147·25	320·421	Kyabram Masterpiece	April
St. Andrew's Gem 16th	M. C. Lester, Glengallan	8,367·75	352·582	Tabbagong Victory	May
Kenstan Gem	T. W. Fowler, Kenstan	8,050·4	351·96	Trevor Hill Gallant	May
Bantry Bonnie 2nd	D. Sullivan, Rossvale	7,675·2	331·63	Bantry Commodore	May
Bantry Rose 4th	D. Sullivan, Rossvale	8,010·4	331·221	Bantry Commodore	May
Blacklands Carnation 18th	A. Pickels, Proston	7,114·2	285·039	Blacklands Gloucester	May
Glenore Rosetta	P. J. Donaghy and Son, Malanda	6,726·25	284·863	Alfa Vale Pride 18th	May
St. Andrew's Gentle 2nd	M. C. Lester, Glengallan	6,201·9	272·689	Tabbagong Victory	May
Emby Vale Velvet	Madge Brothers, Southbrook	6,847·7	258·465	Barkworth Master	May
Sunnycrest Una 2nd	A. H. Sokoll, Wondai	5,882·25	254·592	Sunnycrest Victory	May
Lynfield Lucy 2nd	F. E. Birt, Sexton	6,123·95	247·921	Bingleigh Jean's Victory	May
Bingleigh Ethel 3rd	S. J. Lester, Mulgowie	6,131·3	247·674	Blacklands Emblem	May
Murcott Charm 3rd	T. McLennan, Willowvale	6,358·75	238·243	Fairthorn Rainbow's Prince	May
Trevor Hill Vena	T. W. Fowler, Felton	11,278·25	469·446	Fairvale Jellicoe	June
Navillus Gem 3rd	C. O'Sullivan, Greenmount	8,768·1	387·684	Navillus Brightlight	June
Trevor Hill Marvelette	K. A. Ruhle, Motley	7,590·7	386·773	Fairvale Jellicoe	June
Kenstan Opal	T. W. Fowler, Felton	9,279·85	366·860	Trevor Hill Gallant	June
Alfa Vale Star 17th	W. H. Thompson, Nanango	8,675·6	355·606	Alfa Vale Reward 2nd	June
Cedar Valley Rosette	J. H. Fogg, Toogoolawah	8,613·05	347·714	Kyabram Masterpiece	June
Valera Roseleaf 26th	Sullivan Brothers, Pittsworth	6,906·0	317·686	Alfa Vale Pride 2nd	June
Valera Sally 7th (236 days)	Sullivan Brothers, Pittsworth	7,559·75	308·454	Alfa Vale Pride 2nd	June
Valera July	Sullivan Brothers, Pittsworth	6,854·0	306·554	Alfa Vale Pride 2nd	June
Murcott Petunia 2nd	T. McLennan, Willowvale	7,055·95	278·799	Fairthorn Rainbow's Prince	June
Moola Colleen 3rd	I. B. Skerman, Kainkillenbun	6,511·9	273·257	Navillus ReNell	June
Blacklands Flower 20th	G. G. Sperling, Kooralgin	6,122·55	269·451	Blacklands Czar	June
Blacklands Fairy 29th	G. G. Sperling, Kooralgin	6,679·8	267·591	Blacklands Czar	June
Rosemount Cherry 47th	J. H. Fogg, Toogoolawah	6,137·8	260·743	Newstead Gambler	June
Murcott Clara 5th	T. McLennan, Willowvale	6,606·75	243·305	Fairthorn Rainbow's Prince	June
Highfields Perfect 45th	G. G. Sperling, Kooralgin	7,186·2	243·21	Highfields Tiger	June
Ennismore Fancy 5th	E. W. Jackson, Nobby	6,016·65	237·66	Arolla Limerick	June
Wonga Molly	J. Coonan, Cambooya	9,199·5	423·906	Reservior Yenda	July
Blacklands Miss Jean 24th	A. Pickels, Proston	8,288·8	301·201	Blacklands Gloucester	July

PRODUCTION RECORDING—*continued.*

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.	Month Compiled.
		Lb.	Lb.		
AUSTRALIAN ILLAWARRA SHORTHORN—*continued.*					
JUNIOR, 2 YEARS (STANDARD 230 LB.).—*continued.*					
Ronnoc Calm 5th	O'Connor Brothers, Colinton	4,913·55	237·184	Ronnoc General	July
Glen Idol Miss Jean 3rd	Estate of P. Doherty, Gympie	9,528·1	355·734	Glen Idol Coronet	August
Murcott Laurel 3rd	T. McLennan, Willowvale	10,122·45	348·345	Fairthorn Rainbow's Prince	August
Ennismore Florrie 2nd	J. Coonan, Cambooya	7,845·3	337·365	Arolla Limerick	August
Alfa Vale Pet 5th	W. H. Thompson, Nanango	7,994·95	325·045	Penrhos Pansy's Pride	August
Talgai Vale Crummy	R. Herzig, Clifton	7,956·25	325·025	Jamberoo Butter Boy	August
College Dizzy 2nd	Queensland Agricultural High School and College, Lawes	6,339·5	287·189	Alfa Vale Pride 3rd	August
Faversham Doris 40th	H. V. Littleton, Crow's Nest	6,910·9	286·872	Girraween Gideon	August
Derradale Judy	F. Derrick, Monto	6,836·75	275·181	Sunnyview Royal Ruler	August
Sunnyview Rose Petal	J. A. Lane, Kilcoy	6,689·25	264·702	Sunnyview Kitchener	August
Murcott Clara 6th	T. McLennan, Willowvale	6,016·25	238·37	Fairthorn Rainbow's Prince	August
Sunnyside Mabel 25th	S. R. Moore, Wooroolin	6,388·7	232·545	Sunnyside Moneymaker	August
Blacklands Joan 12th	A. Pickels, Proston	6,794·0	318·0	Blacklands Gloucester	September
Faversham Dawn	W. D. Davis, Wambo	7,179·0	265·0	Girraween Gideon	September
Wenlock Beauty 5th	H. G. Watson, Killarney	6,099·0	263·0	Parkview Limerick	September
Wenlock Merle	H. G. Watson, Killarney	6,058·0	247·0	Parkview Limerick	September
Wamba Evelyn 2nd	W. D. Davis, Wambo	6,229·0	245·0	Greyleigh Eros	September
Applegarth Posy 10th	F. Derrick, Moonford	6,357·0	244·0	Fairholm Evidence	September
Lynfield Matron 2nd	F. E. Birt, Sexton	6,366·0	237·0	Bingleigh Jean's Monarch	September
Trevor Hill Vena (365 days)	T. W. Fowler, Pittsworth	14,159·0	594·0	Fairvale Jellicoe	October
Trevor Hill Rosalyn	K. A. Ruhle, Motley	9,357·0	450·0	Fairvale Jellicoe	October
Cleora Gleam	K. Berghofer, Athol	7,508·0	287·0	Rocklea Comet	October
Valera Roseleaf 29th (242 days)	Sullivan Brothers, Pittsworth	6,514·0	280·0	Valera Monarch	October
Applegarth Rosebud 9th	F. Derrick, Moonford	7,261·0	272·0	Fairholm Evidence	October
Cleora Winnie	K. Berghofer, Westbrook	6,453·0	257·0	Rocklea Comet	October
Fermanagh Lila 4th (207 days)	F. B. Sullivan, Pittsworth	5,452·0	241·0	Valera Daphne's Prince	October
Faversham Gideon's Ruby	I. B. Skerman, Kaimkillenbun	4,695·0	234·0	Girraween Gideon	October
JERSEY.					
MATURE COW (STANDARD 350 LB.).					
Windsor Lady Gladys	H. Johnson, Gleneagle	10,737·8	537·384	Brooklands Sultan's Victory	April
Gem Leila	W. Bishop, Kenmore	9,679·8	526·468	Calton Lothean	April
Glenview Vanity	F. Z. Eager, Neurum	8,350·25	475·748	Trinity Governor's Hope	April
Rosedale Maud	W. R. French, Wowan	9,828·4	468·004	Carnation Queen's Duke	April
Trecarne Sweetheart 7th	C. S. Coleman, Cainbabel	7,870·05	465·287	Trecarne Some Duke	April
Tecoma Golden Pet	R. J. Crawford and Sons, Kingaroy	6,896·85	389·209	Trinity Golden Royal	April
Ashview Eva	C. Huey, Sabine	6,752·85	382·116	Trecarne Butter Queen's Officer	April
Erceldine Desire	B. T. Seymour, Kapaldo	7,770·0	370·936	Navua Royalist Prince	April
Ashview Tot	C. Huey, Sabine	7,835·65	366·06	Trecarne Victor 4th	April

Brooklands Merry Jingle Belle	W. S. Conochie, Sherwood	10,580·05	529·996	Bulby Maria's Keepsake	May
Mayfair Roseslip 5th (257 days)	J. Carpenter, Helidon	7,678·95	522·435	Trecarne Golden King 2nd	May
Strathdean Star 2nd	C. W. Carpenter, Warra	8,606·2	461·17	Navua Ladora's Ruler	May
Nairfale Lady Laura	R. J. Browne, Yangan	8,543·8	458·18	Nairfale Noble Count	May
Boree Beauty	W. and C. E. Tudor, Branch Creek	10,202·4	448·493	Boree Soldier Boy	May
Elwyn Brighteyes	E. J. Dunning and Sons, Stanmore	9,279·8	441·747	Glenside Lone Star	May
Upwell Miss Flaxman	B. Seymour, Kapaldo	7,892·25	428·438	Lindley Prince	May
Westwood Dixie	F. Porter, Cambroon	7,756·7	424·275	Westwood Combination	May
Trinity Crowning Poppy	Sinnamon and Sons, Moggill	9,374·7	422·162	Trinity Crowning Effort	May
Brooklands Gold Leaf	W. S. Conochie, Sherwood	8,351·45	414·385	Brooklands Royal Standard	May
Elwyn Favourite	E. J. Dunning and Sons, Stanmore	8,900·65	409·882	Glenside Lone Star	May
Elwyn Dairymaid	E. J. Dunning and Sons, Stanmore	9,332·85	409·747	Glenside Lone Star	May
Glenbrook Lady Lynn	J. F. Lovell, Samford	8,245·45	387·99	Glenbrook Governor	May
Palen Leda	State Farm, Palen Creek	8,024·55	384·007	Banyule Silvermine Oxford	May
Homesdale Spray	J. Oakley, Numinbah Valley	6,437·15	375·203	Homesdale Echo	May
Elwyn Golden Molly	E. J. Dunning and Sons, Stanmore	8,325·95	364·425	Glenside Lone Statr	May
Tecoma Averier	A. Semgreen, Coolabunia	5,969·3	357·263	Oxford Asteroid	May
Kathleigh Silver 2nd	F. W. Kath, Moffat	10,668·13	642·567	Oxford Daffodil's Victor	June
Geith May (212 days)	W. Bishop, Kenmore	8,790·15	548·663	Laces Volunteer of Ardroy	June
Nairfale Lady Laura (365 days)	R. J. Browne, Yangan	9,215·8	498·486	Nairfale Noble Count	June
Brookland Cunning Drop	W. S. Conochie, Sherwood	10,239·7	475·684	Englorie Cunning Victor	June
Crossley Nora	L. A. Mayfield, Goomeri	9,621·2	427·576	Calton Laddie Boy	June
Ashview Lady 2nd	C. Huey, Sabine	7,164·4	407·671	Trecarne Victor 4th	June
Englebourne Goldie	M. May, Hermitage	7,985·65	403·406	Oxford Floss' Remus	June
Elwyn Juliet	E. J. Dunning and Sons, Stanmore	7,997·8	402·998	Glenside Lone Star	June
Glenrandle Luna	M. J. Kerlin, Killarney	6,996·3	396·705	Bellgarth Stylish	June
Inverlaw White Daisy	R. J. Crawford and Sons, Kingaroy	6,782·15	365·265	Inverlaw Saturn	June
Keystone Morilla 14th	R. D. Johnson, Kingaroy	7,556·75	361·53	Bonnie Vue Gay Peer	June
Palm Ridge Dewdrop	F. Z. Eager, Neurum	8,538·45	358·142	Oxford Jocular Lad	June
Glenrandle Golden Girl	P. Kerlin, Killarney	7,792·75	419·669	Bellgarth Stylish	August
Fauvic Sunnymorn	S. A. Cramb, Noosa Heads	7,980·7	413·456	Navua Kahokas Lad	August
Romsey Stylish Hope	J. Wilton, Killarney	7,613·85	400·233	Bellgarth Stylish	August
Trinity Efforts Lady	D. Wadley, Indooroopilly	8,663·5	400·035	Trinity Crowning Effort	August
Mountain View Seaspray	W. R. French, Wowan	7,062·25	394·774	Pineview Beryl's King	August
Glenrandle Lucy	P. Kerlin, Killarney	7,015·3	384·23	Bellgarth Glory King	August
Glenbrook Golden Lynn	D. Wadley, Indooroopilly	7,327·05	381·125	Lermont Golden Victory	August
Golden Hill June 2nd	J. J. Bugler, Wowan	7,605·05	376·531	Trinity Golden Chance	August
Brooklands Cream Flake	W. S. Conochie, Sherwood	7,303·0	430·0	Englorie Cunning Victor	September
Brooklands Angel Cake	W. S. Conochie, Sherwood	6,757·0	393·0	Bulby Maria's Keepsake	September
O. K. Palatine Florence (Imp.) (252 days)	Q.A.H.S. and College, Lawes	6,623·0	371·0	Lobelia Palatine Sultan	September
Trinity Cute Maisie	G. Harley, Childers	7,288·0	370·0	Trinity Cute Prince	September
Fauvic Sunnymorn (365 days)	S. A. Cramb, Noosa Heads	9,977·0	515·0	Navua Kahokas Lad	October
Palmridges Sylvina (255 days)	H. Sigley, Jaggan	9,984·0	515·0	Overlook Financier	October
Fauvic Marmay	S. A. Cramb, Noosa Heads	7,981·0	405·0	Condong Marabean	October

SENIOR, 4 YEARS (STANDARD 330 LB.).

Wyreene Daisy Bell (365 days)	C. W. and E. M. Barlow, Boodua	11,397·4	598·626	Wyreene Marcella's Boy	April
Ashview Lady 3rd	C. Huey, Sabine	7,839·85	462·287	Trecarne Victor 4th	April
Glenview Golden Eblis	F. Z. Eager, Neurum	6,902·6	384·13	Trinity Governor's Hope	April
Gunawah Tulip	R. D. Johnson, Kingaroy	7,590·35	366·161	Gunawah Jack Frost	April
Trinity Efforts Royal	Sinnamon and Sons, Moggill	9,355·3	474·619	Trinity Crowning Effort	May
Lermont Posy 3rd	J. Ahern, Conondale	7,461·85	404·383	Selsey Samares Hallmark	May
Marshlands Royal Lady (Imp.)	F. W. Kath, Moffat	10,605·82	607·261	Brampton's Dreaming Royal	June
Trecarne Doreen 6th	H. T. W. Barker, Devonpark, Oakey	8,501·6	479·274	Trecarne Some Duke	June
Westwood Snowbells	F. Porter, Cambroon	6,196·95	377·626	Westwood Combination	June
Inverlaw Royal Phyllis	R. J. Crawford and Sons, Kingaroy	6,725·1	373·926	Oxford Royal Lad	July
Trecarne Rosebud 8th	I. L. M. Borchert, Kingaroy	5,931·85	365·006	Trecarne Some Duke	August
Westbrook Bells 14th	Farm Home for Boys, Westbrook	7,552·25	359·927	Westbrook Ambassador 52nd	August

PRODUCTION RECORDING—*continued*.

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.	Month Compiled.
		Lb.	Lb.		
	JERSEY—*continued*.				
	JUNIOR, 4 YEARS (STANDARD 310 LB.).				
Westbrook Tulip 138th	C. M. Carpenter, Warra	6,694·0	368·809	Mornmoot Clementine's Valour	May
Lermont Madeira 3rd	J. McCarthy, Greenmount	6,839·65	407·405	Trinity Noble Effort	June
Trecarne Daffodil's Jewel	H. Sigley, Jaggan	6,078·35	367·26	Trecarne Ruler	June
Gem Ida	D. Wadley, Indooroopilly	6,680·1	356·343	Bulby Oxford Gamboge	June
Strathdean Victor's Dolly	C. M. Carpenter, Warra	8,307·96	450·721	Oxford King's Victor	July
Nairfale Mayday	R. J. Browne, Yangan	6,488·6	317·708	Nairfale Count's Paymaster	August
Brooklands Merry Prudence	W. S. Conochie, Sherwood	7,292·0	404·0	Bulby Maria's Keepsake	September
Mayfair Joybell	J. W. Carpenter, Flagstone Creek	6,171·0	365·0	Lermont Double Volunteer	September
Burnlea Matilda	A. E. Trigger, Didcot	6,038·0	325·0	Woodside Rochette's Monarch	September
	SENIOR, 3 YEARS (STANDARD 290 LB.).				
Grasmere Victory's Charm	F. Z. Eager, Neurum	7,891·35	454·001	Oxford Brown Victory	April
Mountain View Fawny (243 days)	W. R. French, Wowan	7,268·5	338·029	Brookland Crumpet	April
Mountain View Brown Charm (228 days)	W. R. French, Wowan	7,048·3	301·149	Brookland Crumpet	April
Kathleigh Attraction	F. W. Kath, Moffat	9,404·07	540·925	Oxford Daffodil's Victory	May
Nairfale Likeness	R. J. Browne, Yangan	8,849·2	459·146	Nairfale Golden Recorder	May
Trinity Cute Princess 2nd	Sinnamon and Sons, Moggill	8,980·7	434·692	Samares Cute Prince 3rd (Imp.)	May
Nairfale Trinket	R. J. Browne, Yangan	6,942·6	371·224	Nairfale Count's Prominence	May
Manneum Morilla	R. D. Johnson, Kingaroy	7,081·8	364·496	Nimbrae Promoter	May
Lermont Mischief	J. Schull, Oakey	6,143·1	358·413	Trinity Noble Effort	May
Glenrandle Lottie	P. Kerlin, Killarney	6,265·3	351·008	Bellgarth Glory King 2nd	May
Mountain View Brown Charm	W. R. French, Wowan	7,856·05	344·929	Brooklands Crumpet	May
Nairfale Likeness (305 days)	R. J. Browne, Yangan	9,512·7	493·082	Nairfale Golden Recorder	June
Westwood Melva	F. Porter, Cambroon	7,956·1	482·677	Trecarne Golden King 2nd	June
Boree Cute Daisy	W. and C. E. Tudor, Branch Creek	8,562·4	441·121	Trinity Cute Commodore	June
Nairfale Trinket (305 days)	R. J. Browne, Yangan	7,505·2	404·966	Nairfale Count's Prominence	June
Palen Lotus 2nd	H.M. Prison, Palen Creek	7,007·35	355·521	Palen Optician	June
Myrtledale Rosealea	H. Sigley, Jaggan	5,507·1	319·648	Palm Ridges Golden Symbol	June
Manneum Cosmos 2nd	R. D. Johnston, Kingaroy	8,135·3	473·7	Nim Brae Promoter	August
Glenside Ellen	G. and V. Beattie, Antigua	7,879·6	373·471	Navua Dreaming Brave	August
Nairfale Gentle (305 days)	R. J. Browne, Yangan	6,336·7	330·756	Nairfale Golden Recorder	August
Nairfale Gentle	R. J. Browne, Yangan	6,049·1	312·154	Nairfale Golden Recorder	August
Hocknell Volunteer Ginger Cake	L. E. Harmer, Beaudesert	7,031·0	394·0	Navua Sporting Volunteer	September
Windsor Princess Florence	H. Johnson, Gleneagle	6,575·0	377·0	Bobs of Wingate	September
Goldlands Daffodil	C. Beckingham, Everton Park	7,586·0	378·0	Calton Lotmyle	October
	JUNIOR, 3 YEARS (STANDARD 270 LB.).				
Westbrook Bells 17th	C. M. Carpenter, Warra	8,314·56	461·199	Westbrook Silvermine Valour	May
Romsey Bonnie Beauty	J. Wilton, Killarney	7,579·7	413·673	Bellgarth Lancer 3rd	May
Brooklands Merry Rosanna	W. S. Conochie, Sherwood	7,047·2	392·026	Bulby Maria's Keepsake	May
Lermont Kitten	J. Schull, Oakey	6,404·25	328·041	Trinity Noble Effort	May
Trinity Sparkling Crescent	F. W. Kath, Moffat	8,274·23	447·256	Trinity National Victory	June

Boree Cute Beauty	W. and C. E. Tudor, Branch Creek	9,060·7	438·126	Trinity Cute Commodore	June
Kathleigh Valmay	F. W. Kath, Moffat	7,165·2	433·649	Oxford Daffodil's Victor	June
Glenrea Melody	C. Beckingham, Everton Park	7,303·74	368·186	Brampton Bandmaster	June
Woodview Fairyfly	L. E. Marsden, Canaga	5,226·9	292·407	Trecarne Royal Officer	June
Grasmere Victorious Camille	Q.A.H.S. and College, Lawes	5,628·3	274·478	Navua Victorious Samaritan	July
Glenrandle Lulu	M. J. Kerlin, Killarney	7,860·5	444·438	Oxford Noble Peer	August
Trinity National Daffodil	F. W. Kath, Moffat	6,985·6	387·004	Trinity National Victory	August
Westbrook Tulip 143rd	Farm Home for Boys, Westbrook	6,543·85	347·276	Selsey Royal Standard	August
Navua Egretta 3rd	P. J. L. Bygrave, Aspley	5,764·45	326·972	Elm Hill Volxenia Nobly Born (Imp.)	August
Nairfale Coquette	R. J. Browne, Yangan	5,934·8	304·826	Kelvinside Handsome Boy	August
Glenmoore May Rose	I. L. M. Borchert, Kingaroy	5,219·15	290·969	Glenmoore May King	August
Tecoma Averiel	A. Semgreen, Coolabunia	5,004·35	278·435	Glenview Royal Chief	August
Glenside Ivory	G. and V. Beattie, Antigua	4,801·65	270·263	Oxford Dudley	August
Kenilworth Midget	I. J. L. Evans, Cooroy	6,298·0	349·0	Rosevale War Bond	September
Nairfale Coquette (305 days)	R. J. Browne, Yangan	6,322·0	331·0	Kelvinside Handsome Boy	September
Coolbar Ramona	I. L. M. Borchert, Kingaroy	6,649·0	329·0	Glenmoore Jean's Royal	September
Nairfale Comedy's Design	R. J. Browne, Yangan	5,284·0	295·0	Kelvinside Handsome Boy	September
Lermont Golden Kate 2nd	J. Schull, Oakey	4,588·0	291·0	Trinity Graceful Duke	September
Ashview Gift	C. Huey, Sabine	5,375·0	288·0	Trecarne Victor 4th	September
Trecarne Rosebud 9th	I. L. M. Borchert, Kingaroy	5,273·0	278·0	Trecarne Golden Lad	September
Fauvic Playful	W. J. Blair, Cooroy	5,071·0	271·0	Glengarriffe Ceasar's Flavius	September
Mountain View Maiden	W. R. French, Wowan	7,673·0	398·0	Brookland Crumpet	October
Wyalla Tottie	C. M. Carpenter, Warra..	6,604·0	363·0	Trecarne Supreme 3rd	October
Trinity Prim Lass	D. Wadley, Indooroopilly	5,929·0	316·0	Trinity Crowning Effort	October

SENIOR, 2 YEARS (STANDARD 250 LB.).

Cedars Silver Wattle	C. M. Carpenter, Warra..	7,017·62	397·465	Cedars King	April
Tecoma Fern	R. D. Johnson, Kingaroy	5,120·0	266·783	Trinity Golden Royal	April
Morago White Xmas (225 days)	W. R. French, Wowan	6,123·0	266·764	Brookland Merry Charmer	April
Trinity Keeper's Darling	D. Wadley, Indooroopilly	5,141·0	263·552	Trinity Cute Effort	April
Trinity National Daisy	Sinnamon and Sons, Moggill	8,244·5	441·527	Trinity National Victory	May
Wyalla Crescent 2nd	Farm Home for Boys, Westbrook	7,037·0	401·953	Trecarne Supreme 3rd	May
Cedars Dandelion..	C. M. Carpenter, Warra	7,144·17	398·357	Cedars King	May
Brooklodge Ada	J. Ahern, Conondale	6,027·75	358·645	Trinity Mighty Prince	May
Nairfale Idol's Delight	R. J. Browne, Yangan	6,428·1	341·128	Nairfale Golden Recorder	May
Mayfair Lady Gay	J. W. Carpenter, Helidon	5,334·9	328·193	Lermont Double Volunteer	May
Lermont Silverbell 3rd	J. Schull, Oakey	5,759·85	315·172	Trinity Graceful Duke	May
Connemara Mistress Olga	J. Ahern, Conondale	5,205·75	315·042	Glenview Lochiel	May
Brooklands Regal Maid	W. S. Conochie, Sherwood	5,571·05	312·721	Brooklands Regalia	May
Inverlaw Cynthia..	R. J. Crawford and Sons, Kingaroy	5,428·7	302·756	Inverlaw Royalist	May
Trinity Crowning Royal	Sinnamon and Sons, Moggill	5,540·4	299·837	Trinity Crowning Effort (Imp.) ..	May
Carnation Peeress	W. Spresser and Son, West Ipswich	5,050·0	257·686	Oxford Fawn's Victor	May
Carnation Marina..	W. Spresser and Son, West Ipswich	5,660·2	256·261	Oxford Fawn's Victor	May
Manneum Dawn's Pride	R. D. Johnson, Kingaroy	5,649·3	297·818	Nimbrae Promoter	May
Windsor Royal Beatrice	H. Johnson, Gleneagle	8,559·4	420·231	Brookland Merry Monarch	June
Nairfale Idol's Delight (305 days)	R. J. Browne, Yangan	6,962·1	370·503	Nairfale Golden Recorder	June
Boree Effort's Lily	W. and C. E. Tudor, Branch Creek	7,345·07	357·137	Trinity Daffodil's Effort	June
Sunny Glen Vera 3rd	J. McCarthy, Greenmount	7,375·9	349·162	Ivy Bank Lad	June
Inverlaw Princess Phyllis	R. J. Crawford and Sons, Kingaroy	6,314·35	343·928	Inverlaw Royalist	June
Brooklodge Carolyn	J. J. Ahern, Conondale	5,881·25	330·088	Trinity Mighty Prince	June
Inverlaw Lenora	R. J. Crawford and Sons, Kingaroy	6,224·35	295·833	Inverlaw Royalist	June
Inverlaw Royal Dairymaid	R. J. Crawford and Sons, Kingaroy	5,413·45	277·908	Oxford Royal Lad	June
Minidong Maid (305 days)	R. J. Browne, Yangan	7,281·9	384·454	Balwyn's Fancy Baron	August

PRODUCTION RECORDING—*continued.*

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.	Month Compiled.
		Lb.	Lb.		
		JERSEY—*continued.*			
		SENIOR, 2 YEARS (STANDARD 250 LB.)—*continued.*			
Minidong Maid	R. J. Browne, Yangan	7,087·5	370·548	Balwyn's Fancy Baron	August
Brooklodge Joyful Girl	J. Ahern, Conondale	6,359·9	351·376	Trinity Mighty Prince	August
Hillsdale Charm	A. S. Grant, Greenwood	5,444·7	312·678	Rosallen Laddie	August
Tecoma Blue Columbine	A. Semgreen, Coolabunia	5,764·9	291·744	Austral Park Double Blue	August
Trinity Cute Lady 2nd	D. Wadley, Indooroopilly	6,215·6	285·776	Trinity Cute Effort	August
Hillsdale Eileen	A. S. Grant, Greenwood	5,612·9	285·483	Rosallen Laddie	August
Grasmere Noble Gleam	M. May, Hermitage	6,266·55	273·954	Springhurst Noble Oak	August
Boree Efforts Auriel	G. and V. Beattie, Antigua	5,777·0	267·0	Trinity Daffodil's Effort	September
Westwood Majesty	F. Porter, Cambroon	6,464·0	442·0	Trecarne Golden King 2nd	October
Ashview Hazeldale	C. Huey, Sabine	5,960·0	312·0	Trecarne Some Tot's Duke 2nd	October
Laurena Royal Tulip	L. E. Harmer, Beaudesert	5,867·0	301·0	Golden View Some Hope	October
		JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Brookland Regal Laurel Leaf	W. S. Conochie, Sherwood	5,736·2	313·22	Brooklands Regalia	April
Myrtledale Sweetheart	H. Sigley, Jaggan	5,571·7	312·528	Palm Ridges Golden Victory	April
Nairfale Chenille (365 days)	R. J. Browne, Yangan	6,069·6	298·947	Kelvinside Handsome Boy	April
Ashview Some Lady	C. Huey, Sabine	5,286·8	298·347	Trecarne Some Tot's Duke 2nd	April
Inverlaw Dark Petal	R. D. Johnson, Kingaroy	5,557·3	293·508	Oxford Royal Lad	April
Brooklands Regal Monica	W. S. Conochie, Sherwood	5,797·8	287·742	Brooklands Regalia	April
Brooklands Regal Rose	W. S. Conochie, Sherwood	5,388·7	284·776	Brooklands Regalia	April
Bellgarth Nancy	D. R. Hutton, Cunningham	4,790·3	271·483	Gem Rodney 2nd	April
Nindet Ana Ila	D. Wadley, Indooroopilly	4,748·85	267·348	Trinity Valiant Effort	April
Hill 60 Golden Thread	R. J. Browne, Yangan	4,934·9	257·241	Kelvinside Dream Boy	April
Fauvic Refund	H. Cochrane, Kin Kin	5,054·9	256·487	Fauvic Trial Link	April
Carnation Kitty	W. Spresser and Son, Rosewood	5,413·85	244·212	Oxford Fawn's Victor	April
Trinity Effort's Duchess	J. S. McCarthy, Greenmount	4,518·65	236·501	Trinity Crowning Effort	April
Westwood Sunglow	F. Porter, Cambroon	5,905·9	389·222	Devon Park Madiera's Victorious	May
Westwood Rainbird	F. Porter, Cambroon	6,992·75	358·859	Devon Park Madiera's Victorious	May
Mayfair Golden Girl	J. W. Carpenter, Helidon	5,716·2	358·702	Trinity Crowning Admiral	May
Trinity Crowning Gem	Sinnamon and Sons, Moggill	6,300·75	336·002	Trinity Crowning Effort	May
Westbrook Tulip 147th	Farm Home for Boys, Westbrook	5,718·25	334·414	Westbrook Comet 17th	May
Inverlaw Remus Syria	R. J. Crawford and Sons, Kingaroy	5,873·25	329·427	Oxford Royal Lad	May
Oxford Corinne	V. Granger, Numinbah Valley	6,220·85	311·577	Glenview Royal Chief	May
Tecoma Blue Pet	A. Semgreen, Coolabunia	4,795·7	312·468	Austral Park Double Blue	May
Glen Erin Viola	J. McCarthy, Greenmount	5,851·4	308·211	Ashfield Prometheus	May
Inverlaw Brown Phyllis	R. J. Crawford and Sons, Kingaroy	5,492·45	305·814	Grasmere Brown Victory	May
Westwood Minion	F. Porter, Cambroon	5,036·2	300·111	Devon Park Madiera's Victorious	May
Brook Lodge Viole	J. Ahern, Conondale	4,797·7	297·51	Trecarne Some Victor 4th	May
Trinity Victory's Princess	Sinnamon and Sons, Moggill	5,801·1	294·661	Trinity National Victory	May
Brook Lodge Petunia	J. Ahern, Conondale	4,908·05	292·755	Trecarne Some Victor 4th	May
Glenview Skipton's Gay Girl	V. Granger, Numinbah Valley	5,703·5	282·599	Oxford Skipton	May
Brookland Regal Cream Lass	W. S. Conochie, Sherwood	5,117·2	281·219	Brookland Regalia	May
Brookland Regal Myrtle	W. S. Conochie, Sherwood	4,873·75	276·856	Brookland Regalia	May
Nairfale Sapphire	R. J. Browne, Yangan	5,933·6	274·347	Kelvinside Handsome Boy	May

Trinity Lady Lass	Sinnamon and Sons, Moggill	5,153·0	264·972	Trinity National Victory	May
Navua Cecilia's Strike 2nd	P. J. L. Bygrave, Aspley	5,751·94	261·049	Navua Sociable Designer	May
Glenrae Ballerina	J. Oakley, Numinbah Valley	4,684·0	259·748	Oxford Skipton	May
Glenrae Sea Foam (234 days)	D. R. Winchester, Numinbah Valley	4,826·35	258·952	Trecarne Some Duke	May
Oxford Royal Francis	E. Burton and Sons, Wanora	5,017·3	256·822	Glenview Royal Chief	May
Ashview Larkspur 2nd	C. Huey, Sabine	5,053·1	251·074	Trecarne Victor 4th	May
Inverlaw Hilda	H. Sigley, Jaggan	4,188·25	244·949	Inverlaw Councillor	May
Heatherlea Blossom	J. A. Smith, Chinchilla	4,796·4	240·353	Colindale Socks	May
Oxford Royal Creole	E. Burton and Sons, Wanora	5,398·15	239·196	Glenview Royal Chief	May
Burnlea Doris	A. E. Trigger, Didcot	5,272·85	233·931	Woodside Rochette's Monarch	May
Kathleigh Royal Lady	F. W. Kath, Moffat	7,353·08	426·545	Kathleigh Masterman	June
Boree Cute Coral	W. and C. E. Tudor, Branch Creek	8,009·55	396·099	Trinity Cute Commodore	June
Westwood Royal Joy	F. Porter, Cambroon	6,682·5	385·104	Devonpark Madiera's Victorious	June
Weelu Hardship's Effort	C. W. and E. M. Barlow, Boodua	5,077·05	383·068	Trinity Lily's Effort	June
Windsor Royal Ruth	H. Johnson, Gleneagle	6,273·0	339·745	Brookland Merry Monarch	June
Connemara Cream Maid	J. Ahern, Conondale	6,001·95	339·613	Glenview Lochiel	June
Westwood Vienna	F. Porter, Cambroon	6,046·75	336·75	Devon Park Madiera's Victorious	June
Grasmere Golden Skylark	F. Z. Eager, Neurum	6,354·7	315·012	Oakleigh Golden Pride	June
Oxford Victorious	E. Burton and Sons, Wanora	6,013·4	310·837	Oxford Franklyn	June
Nairfale Sapphire (305 days)	R. J. Browne, Yangan	6,388·7	297·308	Kelvinside Handsome Boy	June
Connemara Royal Bangle	J. Ahern, Conondale	4,920·4	294·005	Belgonia's Flashlight	June
Glen Erin Molly	J. McCarthy, Greenmount	5,513·3	292·044	Ashfield Prometheus	June
Nindethana Louise	D. Wadley, Indooroopilly	5,633·65	285·541	Trinity Cute Effort	June
Oxford Florizel	E. Burton and Sons, Wanora	6,125·2	272·005	Glenview Royal Chief	June
Westwood Bubbles	F. Porter, Cambroon	4,832·55	269·992	Devon Park Madiera's Victorious	June
Grasmere Twinkle's Gloria	F. Z. Eager, Neurum	5,055·6	268·552	Grasmere Twinkle's Victory	June
Elwyn Charming	E. J. Dunning and Sons, Stanmore	5,653·5	265·874	Navua Noble Lad	June
Oxford Royal Flake	E. Burton and Sons, Wanora	5,202·15	258·195	Glenview Royal Chief	June
Oxford Floretta	E. Burton and Sons, Wanora	5,829·0	252·447	Glenview Royal Chief	June
Fairford Design's Lupin	L. A. Mayfield, Goomeri	5,551·9	251·692	Trinity Crowning Ensign	June
Mount Carmel Trixie's Maid	A. S. Grant, Greenwood	4,241·95	237·82	Hocknell Volunteer Bounce	June
Upwell Miss Noteworthy	E. W. Goody, Bancroft	4,494·0	236·657	Glenview Some Sultan	June
Parkview Merry Tot	H. T. W. Barker, Oakey	4,945·45	234·608	Brookland Merry Cavalier	June
Upwell Fay Fawn	E. W. Goody, Bancroft	4,483·5	230·297	Glenview Some Sultan	June
Carnation Princess June	Queensland Agricultural High School and College, Lawes	6,933·5	382·897	Oxford Fawn's Victor	July
Parkview Merry Lass	H. T. W. Barker, Oakey	7,121·25	362·02	Brookland Merry Cavalier	July
Carnation Cream Girl	Queensland Agricultural High School and College, Lawes	5,906·7	353·904	Oxford Fawn's Victor	July
Tecoma Myrtle	A. Semgreen, Coolabunia	5,933·95	328·67	Austral Park Double Blue	July
Parkview Merry Princess	H. T. W. Barker, Oakey	6,314·15	266·465	Brookland Merry Cavalier	July
Gem Cream Lily	W. Bishop, Kenmore	4,279·55	249·127	Gem Loyal Highness	July
Coraldale Pretty Maid	W. A. White, Peeramon	4,268·15	241·319	Peeramon Britain	July
Ashview Golden Peal	C. Huey, Sabine	4,916·6	231·722	Trecarne Victor 4th	July
Laurena Lady Belle	L. E. Harmer, Beaudesert	4,647·2	230·901	Brookland Merry Signalles	July
Boree Efforts Briar (365 days)	D. J. Louttit, Moonford	12,411·25	616·47	Trinity Daffodil's Effort	August
Kathleigh Silversheen	F. W. Kath, Moffat	7,612·09	438·374	Kathleigh Masterman	August
Kathleigh Noble's Daffodil	F. W. Kath, Moffat	7,703·35	416·464	Oxford Fawn's Noble	August
Glen Erin Viola (365 days)	J. McCarthy, Greenmount	7,318·25	405·282	Ashfield Prometheus	August
Boree Cute Peggy	W. and C. E. Tudor, Gayndah	7,914·25	396·829	Trinity Cute Commodore	August
Kathleigh Pontorson	F. W. Kath, Moffat	6,689·41	369·075	Oxford Fawn's Noble	August
Ellerdale Watfern Berenice	J. McCarthy, Greenmount	5,721·0	351·153	Ellerdale Watfern Gamboge	August
Golden Hill Roselean	J. Bugler, Wowan	5,788·55	310·125	Golden Hill Joker	August
College Florette 11th	Queensland Agricultural High School and College, Lawes	5,899·9	26[illegible]·583	Westbrook Ambassador 52nd	August
Glenside Dalice	Queensland Agricultural High School and College, Lawes	5,153·4	262·636	Oxford Dudley	August

PRODUCTION RECORDING—*continued*.

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.	Month Compiled.
		Lb.	Lb.		
	JERSEY—*continued*.				
	JUNIOR, 2 YEARS (STANDARD 230 LB.).—*continued*.				
Glenside Goldenia	Queensland Agricultural High School and College, Lawes	5,005·0	259·776	Oxford Dudley	August
Mount Carmel Silver Moonbeam	A. S. Grant, Greenwood	4,680·55	238·901	Hocknell Volunteer Bounce	August
Oxford Louella	Queensland Agricultural High School and College, Lawes	4,300·9	232·427	Oxford Franklin	August
Nairfale Noble's Esteem	R. J. Browne, Yangan	5,714·0	333·0	Nairfale Pride's Noble	September
Mayfair Charm	J. W. Carpenter, Flagstone Creek	5,662·0	329·0	Lermont Double Volunteer	September
Windsor Royal Melody	H. Johnson, Gleneagle	5,550·0	306·0	Brookland Merry Monarch	September
Silverbrook Belarine	J. Schull, Oakey	5,351·0	305·0	Trinity Graceful Duke	September
Myrtledale Duchess	H. Sigley, Jaggan	4,877·0	294·0	Palm Ridges Golden Victory	September
Willow Bank Gold Wings	I. L. M. Borchert, Kingaroy	5,450·0	289·0	Inverlaw Observer	September
Willow Bank Mottle Fortune	I. L. M. Borchert, Kingaroy	4,233·0	281·0	Brampton Daffodils Peer	September
Brook Lodge Silicia 2nd	J. Ahern, Conondale	4,314·0	279·0	Trecarne Some Victor 4th	September
Fauvic Marion	W. J. Blair, Cooroy	5,445·0	247·0	Fauvic Cornet	September
Willow Bank Glee	I. L. M. Borchert, Kingaroy	4,603·0	233·0	Inverlaw Observer	September
Westwood Waratah	F. Porter, Cambroon	7,093·0	397·0	Glenview Lochiel	October
Nairfale Noble's Esteem (305 days)	R. J. Browne, Yangan	6,173·0	365·0	Nairfale Pride's Noble	October
Westwood Silver Leaf	F. Porter, Cambroon	5,493·0	292·0	Devon Park Madiera's Victorious	October
Laurena Majesty Belle	L. Massam, Gleneagle	5,943·0	267·0	Golden View One More	October
Woodview Elaine	L. E. Marsden, Canaga	3,914·0	231 0	Woodview Officer	October
	GUERNSEY.				
	MATURE COW (STANDARD 350 LB.).				
Willowbrae Verture	L. G. McKewen, Binjour	8,546·42	369·27	Linwood Peace Boy	May
Willowbrae Victoria	L. G. McKewen, Binjour	7,933·53	351·659	Linwood Peace Boy	May
Linwood Birdie	E. G. Foxton, Maleny	7,547·55	418·959	Linwood Rex	August
Tattenbah Primrose	W. A. K. Cooke, Witta	8,536·85	410·253	Laureldale Trump	August
	SENIOR, 4 YEARS (STANDARD 330 LB.).				
Brookside Narelle	E. R. Evans, Loganlea	7,229·8	357·266	Brookside Harry Lauder	April
Oakwood Winkie	D. C. Johnston, Beaudesert	6,830·0	394·0	Fairfield Winner	October
	JUNIOR, 4 YEARS (STANDARD 310 LB.).				
Oakwood Fay	D. C. Johnston, Logan Village	8,614·35	375·953	Fairfield Winner	April
Glenfield Empress (210 days)	A. A. Huth, Roadvale	6,777·7	332·826	Maidavale Baron	May
Oakwood Gloria	D. C. Johnston, Logan Village	7,349·3	359·364	Fairfield Winner	June
	SENIOR, 3 YEARS (STANDARD 290 LB.).				
Adaville Honest Girl	G. Miller, Chamber's Flat	7,992·0	331·505	Laureldale Pluto	April
Oakwood Cherry	W. H. Doss, Degilbo	7,323·15	298·296	Fairfield Winner	May
	JUNIOR, 3 YEARS (STANDARD 270 LB.).				
Fernhill Rose Royal	D. C. Johnston, Beaudesert	6,939·0	356·0	Cooroora View Chance	October

		SENIOR, 2 YEARS (STANDARD 250 LB.).			
Fernhill Julie	G. Miller, Chamber's Flat	6,540·65	311·247	Cooroora View Chance	April
Adaville Caress	J. M. Cooke, Witta	7,332·4	329·976	Linwood Guess	June
Adaville Sweet Girl	J. M. Cooke, Witta	6,075·1	290·44	Linwood Guess	June
Adaville Moonshine	J. M. Cooke, Witta	5,575·7	275·917	Linwood Guess	June
Adaville Musk	J. M. Cooke, Witta	5,650·85	252·986	Linwood Guess	June
		JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Oakwood Honour	W. H. Doss, Degilbo	7,254·4	315·7	Fairfield Winner	May
Brookland Leah	J. M. Cooke, Maleny	5,663·4	297·5	Brookland Landes Lad	May
Toba Beauty	E. G. Foxton, Maleny	5,315·2	252·963	Linwood Hurricane	June
Brookland Leah (amended)	J. M. Cooke, Witta	5,440·2	292·362	Brookland Landes Lad	July
Brookland Winsome (amended)	J. M. Cooke, Witta	5,216·5	256·075	Brookland Landes Lad	July
Brynworth Peace Lady	A. A. Huth, Roadvale	5,221·05	242·234	Moongi Bonnie Willie	July
Brynworth Charm	A. A. Huth, Roadvale	5,159·9	240·943	Moongi Bonnie Willie	July
Toba Choice	E. G. Foxton, Maleny	5,431·15	268·797	Wirrawong Winter	August
Fernhill Queen Anne	D. C. Johnston, Beaudesert	6,322·0	317·0	Laureldale Violet's Sequel	September
Toba Butterfly	E. G. Foxton, Maleny	4,118·0	240·0	Wirrawong Winter	September
Brookland Neridah	J. M. Cooke, Witta	4,494·0	234·0	Brookland Landes Lad	September
		AYRSHIRE.			
		MATURE COW (STANDARD 350 LB.).			
Eleresley Leila	Stimpsons Ltd., Loganlea	9,396·8	386·334	Benbecula Banker	April
Eleresley Mona	Estate of Stimpsons Ltd., Loganlea	8,550·8	356·338	Holly Green Gold Prince	May
Benbecula Rosamund	L. Holmes, Yarranlea	8,836·75	379·76	Myola Jean's Monarch	June
Benbecula Lady Bliss	L. Holmes, Yarranlea	8,140·35	355·227	Benbecula Tina's Willie	August
Benbecula Luxurious	L. Holmes, Yarranlea	9,746·0	374·0	Myola Jean's Monarch	September
		JUNIOR, 3 YEARS (STANDARD 270 LB.).			
Benbecula Bernadette (254 days)	Lovell Holmes, Yarranlea	6,721·65	286·85	Benbecula Marquis	April
Benbecula Bernadette	L. Holmes, Yarranlea	6,800·5	291·478	Benbecula Marquis	May
Eleresley Miss Bee 2nd	Estate of Stimpsons Ltd., Loganlea	7,091·45	287·222	Auchen Eden Miracle	May
Eleresley Fay 2nd	Stimpsons Ltd., Loganlea	7,612·8	296·921	Auchen Eden Miracle	August
Benbecula Theresa	L. Holmes, Yarranlea	7,693·05	282·959	Benbecula Marquis	August
Eleresley Gay Girl 2nd	Stimpsons Ltd., Loganlea	8,303·0	340·9	Oaklands Q. Dan	September
		SENIOR, 2 YEARS (STANDARD 250 LB.).			
Eleresley Mamie 4th	Stimpsons Ltd., Loganlea	7,448·5	280·828	Oaklands Q. Dan	August
		JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Fairhill Hulda	M. J. Brownlie, Nangwee	5,977·7	241·638	Myola Master 2nd	May
Leafmore Sonda Henie	J. P. Ruhle, Motley	7,460·5	305·611	St. Christoper's Hazel Boy	June
Leafmore Huly	J. P. Ruhle, Motley	6,811·5	301·622	St. Christopher's Hazel Boy	June
Leafmore Sherryl	J. P. Ruhle, Motley	6,521·95	279·929	Myola Jaunt 2nd	June
Leafmore Humerous	J. P. Ruhle, Motley	6,944·0	272·825	St. Christopher's Hazel Boy	June
Fairhill Anita	M. J. Brownlie, Nangwee	6,559·2	273·494	Myola Master 2nd	July
Eleresley Cynthia 2nd	Stimpsons Ltd., Loganlea	6,461·15	274·882	Auchen Eden Miracle	August
Leafmore Phyllis 2nd	J. P. Ruhle, Motley	6,562·75	256·754	St. Christopher's Hazel Boy	August
Leafmore Hedley (242 days)	J. P. Ruhle, Motley	5,460·75	235·337	St. Christopher's Hazel Boy	August
		FRIESIAN.			
		MATURE COW (STANDARD 350 LB.).			
St. Athans Sunny Angel	C. H. Naumann, Yarraman	14,994·85	480·308	Tent Hill Sunlight	June
St. Athans Piebe Annette 2nd	C. H. Naumann, Yarraman	15,984·0	506·0	Greenvale Segis Piebe 3rd	September
		JUNIOR, 4 YEARS (STANDARD 310 LB.).			
Brigalow Dutchmaid 9th	C. H. Naumann, Yarraman	10,903·2	371·767	Inavale Tresiland Chief	April

ANIMAL HEALTH

"Blight" (Ophthalmia) in Farm Animals.

A. L. CLAY, Assistant Director, Division of Animal Industry.

BLIGHT is an inflammatory condition affecting one or both eyes of farm animals, especially cattle and sheep; pigs are rarely affected, but it is met with fairly commonly in horses. It is also sometimes known as "pink eye" or yet again as infectious keratitis.

It is distinctly seasonal in occurrence, being largely confined to the late summer and early autumn months. Some cases are, however, to be seen in winter, and this is especially the case where calves are concerned.

The condition appears to be world-wide in its distribution.

Cause and Method of Spread.

Blight is in the nature of an infectious disease, although finality is still lacking in the matter of the actual agent or agents involved. There is probably some variation as between different countries and even as between different outbreaks of the disease in the same country.

Spread of the disease is in all probability by means of flies. Close contact of animals, as when yarded for milking or for dipping, branding, or other purposes, especially under dusty conditions, almost certainly assists its spread.

Recovered animals may remain carriers for lengthy periods.

Symptoms.

Symptoms will be well known to most farmers and graziers. One (usually) or both (sometimes) eyes may be affected. There is an excess of tears in the affected eye, the cheek becomes tear stained, and the hair in the area matted. The affected eye takes on an added sensitivity to light, with the result that it is kept partly, and at times completely, closed.

The conjunctiva (inner surface of the eyelid) is inflamed and swollen. A scum or cloudy film appears on the surface of the eyeball; this film may show the presence of highly injected blood vessels not seen in the normal eye. In severe cases there is a bulging of the eyeball and an ulcer forms at the most prominent point of the bulge. The eye then presents a very "angry" appearance indeed.

Without doubt there is pain, and often there is considerable loss of condition. Milk flow (in the case of cows) may be much depressed. Temporary blindness may occur, in which case the loss of condition is much more marked.

Course of the Disease.

Recovery will in most cases occur in 7-14 days without treatment. Severe cases naturally run a more protracted course, but even so it is nothing short of extraordinary how frequently they do eventually return to normal. Often a small white scar remains on the surface of the eyeball, but this is not considered to constitute any serious disability except perhaps where riding horses are concerned.

In a small percentage of cases the disease leads to the loss of sight in the affected eye.

Prevention and Treatment.

Substances which have been used in the past as "cures" are many and various, a sure indication that none among them is outstanding. Kerosene, sugar, salt, calomel, quinine sulphate, iodine, castor oil, milk, zinc sulphate, argyrol, mercurochrome, silver nitrate, bluestone, boric acid, and yellow oxide of mercury have all been recommended at various times.

Whatever one decides to use it has to be accepted that treatment must be carried out more than once or twice daily if best results are to be obtained. The aim should be to instil a non-irritant preparation into the eye, hourly. It is realised, of course, that where animals are concerned there are serious practical difficulties in the way of doing this, but one can only do the best he can to approach the ideal in the matter.

Argyrol is an example of a non-irritant preparation. It is available from chemists and should be obtained in 20 per cent. or even 30 per cent. solution. It is applied to the eye as drops, with the aid of an eye dropper.

Another non-irritant preparation which can be used as often as desired is neutral proflavine sulphate, 1 part in 5,000 parts of water. It also is obtainable from chemists.

Penicillin also lends itself to use in this regard, but there are disadvantages as regards keeping qualities. It is necessary to use freshly dispensed solutions, which should be kept in a refrigerator or ice box when not in actual use.

A more recent remedy, on which it is not yet possible to pass final judgment, is sulphacetamide. It is used as a 10 per cent. watery solution of sodium sulphacetamide.

Zinc sulphate solutions which have been used for many years are tending to go out of favour. They have been used in strengths varying from ½ per cent. to 2½ per cent. in water or in boric acid solution.

Many people prefer to use powders rather than "drops," holding that they are easier to place in the eye. There is probably some merit in this claim, but a suitable "blower," reserved for the purpose, is desirable. Suitable powders to use are boric acid; or a mixture of boric acid 2 parts and sulphanilamide 1 part; or better still, boric acid 2 parts and sulphacetamide 1 part.

For those who prefer to use ointments (placed on the conjunctiva), and they have much to recommend them, penicillin eye ointment is the best preparation. Sulphacetamide can also be obtained in the form of an eye ointment and is worthy of trial.

Whatever the treatment decided upon, it will be of considerable assistance to keep affected animals in a barn or shed where there is subdued light. Where this is not possible, a shade should be made and hung over the affected eye so as to protect it from direct light and also from flies.

Needless to say, where valuable animals are concerned, the services of a veterinary surgeon should, if practicable, be enlisted.

In the matter of prevention there is reason to believe that dipping cattle in DDT preparations has a useful effect in the direction of preventing or reducing the spread of blight in a herd. The assumption is that this results from the control of bush and house flies effected by the DDT. This suggests that it might be a useful procedure to spray the faces of healthy animals with a 5 per cent. solution of DDT once every 7-10 days during periods when blight is prevalent.

The use of vaccines as a preventive has received some attention, but in Australia up to the present time there is little to indicate that a reliable vaccine is in sight. As an attack of the disease followed by recovery does not appear to give lasting immunity, the prospects of ever obtaining a reliable vaccine are only slender.

BETTER DAIRYING DEMONSTRATIONS.

The Minister for Agriculture and Stock (Hon. H. H. Collins) said recently that approved practices recommended for increasing dairy production per cow and per acre have already been applied on the 46 dairy farms selected for the series of demonstrations initiated by the Department.

Th purpose of the demonstrations is to provide an object lesson for dairymen in what may be achieved by the adoption of improved production methods. The 46 farms where owners have agreed to adopt various approved practices on their properties are situated in the Ipswich, Toowoomba, Dalby, Kingaroy, Gympie and Caboolture districts and the Atherton Tableland.

Each group of demonstration farms is supervised by an officer specially appointed for the purpose and data from each farm are being collated to properly assess the value of the demonstrations. Valuable co-operation is being given by the Irrigation and Water Supply Commission and the Bureau of Investigation.

TUBERCULOSIS-FREE CATTLE HERDS
(AS AT 1st JANUARY, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas.

ASTRONOMICAL DATA FOR QUEENSLAND.

MARCH.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.

Day.	Rise.	Set.
	a.m.	p.m.
1	5.41	6.20
6	5.44	6.15
11	5.46	6.10
16	5.49	6.04
21	5.52	5.59
26	5.54	5.53
31	5.57	5.48

MINUTES LATER THAN BRISBANE AT OTHER PLACES.

Place.	Rise.	Set.	Place.	Rise.	Set.
Cairns	29	29	Longreach	35	35
Charleville ..	27	27	Quilpie	35	35
Cloncurry	50	50	Rockhampton ..	10	10
Cunnamulla ..	29	29	Roma	17	17
Dirranbandi ..	19	19	Townsville ..	25	25
Emerald	19	19	Winton	40	40
Hughenden ..	35	35	Warwick	4	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	4.19	1.48
2	5.03	2.51
3	5.43	3.57
4	6.19	5.04
5	6.53	6.10
6	7.27	7.15
7	8·03	8.21
8	8.41	9.29
9	9.25	10.38
10	10.15	11.47
		p.m.
11	11.10	12 54
12	..	1.56
	a.m.	
13	12.11	2.51
14	1.14	3.38
15	2.17	4.19
16	3.17	4.53
17	4.15	5.24
18	5.11	5.53
19	6.04	6.20
20	6.57	6.47
21	7·50	7.15
22	8.43	7.46
23	9.38	8.20
24	10.34	9.00
25	11·31	9.45
	p.m.	
26	12.27	10.35
27	1.20	11·32
28	2.09	..
		a.m.
29	2.54	12.33
30	3.35	1.37
31	4·12	2.42

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie. 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	10	30	26	45	0	21	28	53
6	21	19	37	35	12	10	43	39
11	31	9	47	23	22	0	54	26
16	26	14	42	29	17	4	49	33
21	15	24	30	40	6	15	35	46
26	9	31	25	46	0	22	26	54
31	14	25	30	41	5	16	34	48

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	6	55	35	67	20	52	6	45
3	15	46	40	61	25	47	14	38
5	27	34	49	54	33	39	23	29
7	40	21	57	44	42	29	33	18
9	51	9	65	36	49	22	42	9
11	57	2	69	32	53	17	47	3
13	56	3	68	32	52	18	46	4
15	51	10	65	37	49	23	42	10
17	40	20	57	44	42	29	33	18
19	30	31	51	51	35	36	25	26
21	20	40	43	58	28	43	17	34
23	10	50	37	63	22	49	9	42
25	3	56	34	67	18	53	4	46
27	2	56	33	67	17	53	3	46
29	8	52	36	65	21	50	8	44
31	18	43	42	59	27	45	16	36

Phases of the Moon.—Full Moon, 4th March, 8.34 p.m.; Last Quarter, 11th March, 12.38 p.m.; New Moon, 19th March, 1.20 a.m.; First Quarter, 27th March, 6.09 a.m.

On the 21st March at 3 p.m. the Sun wil cross the Equator on its apparent journey from South to North and on this day wil rise and set at true east and true west respectively.

On the 6th and 19th the Moon will rise and set aproximately at true east and true west respectively.

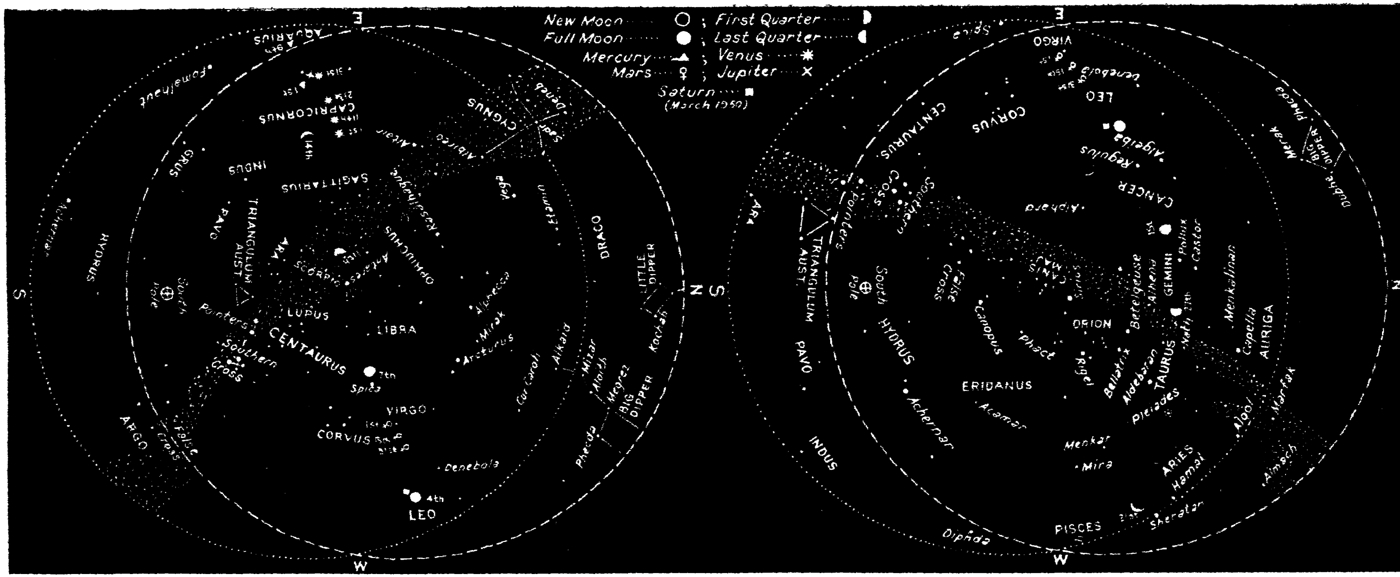
Mercury.—At the beginning of March, in the constellation of Capricornus, will rise 1½ hours before the sun and will remain a morning object until the 28th. By the end of the month, in the constellation of Pisces will set 10 minutes after the Sun.

Venus.—Now a conspicuous object in the morning sky. On the 1st, in the constellation of Capricornus will rise 2½ hours before the Sun and will attain greatest brilliancy on the 6th. By the end of the month, in the constellation of Aquarius, will rise 3 hours 25 minutes before the Sun.

Mars.—Throughout this month favourably placed for observation for almost the whole night. On the 1st, in the constellation of Virgo, it will rise between 7.48 p.m. and 9 p.m. On the 23rd it will be opposite the Sun and at the end of the month, still in the consellation of Virgo, will rise between 5.20 p.m. and 6.30 p.m.

Jupiter.—At 1 a.m. on the 2nd Mercury will pass about one degree south of Jupiter so at the beginning of the month Mercury and Jupiter will be close. At the end of the month, in the constellation of Capricornus, Jupiter will rise between 2.45 a.m. and 4 a.m.

Saturn.—Also favourably placed for observation throughout this month. On the 1st, in the constellation of Leo, will rise between 6.30 p.m. and 8 p.m.; on the 7th will be opposite tne Sun and at the end of Marcn will rise auring the daylight hours.



Star Charts.—The chart on the right is for 7.15 p.m. in the south-east corner of Queensland to 8.15 p.m. along the Northern Territory Border on the 15th March (for every degree of longitude we go west the time increases by 4 minutes). The chart on the left is for 9 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing North hold "N" at the bottom; when facing South hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the Moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

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5

Contents

Chemical Weed Control in Grain Crops.

C. S. CLYDESDALE, Senior Adviser in Agriculture, and J. HART, Adviser in Agriculture.

THE proved efficiency of some recently discovered selective weed-killers and pest control products has created a demand for equipment suitable for the application of these materials to large areas of crops under widely varying conditions. For example, on the Darling Downs there is a steady enquiry for equipment suitable for the chemical control of weeds, particularly wild turnips in winter cereal crops, and for weed and insect pest control in summer grain crops. As both weedicides and insecticides used for these purposes are normally applied in the form of a spray, a spraying unit which can be adapted as required for the application of either of these materials is desirable. In addition, it must be suitable for the rapid treatment of large areas of crop and must be constructed so as to allow regulation of the application rate and adjustments for crop height.

Spraying plants designed to fulfil the above requirements are available in Queensland. These, together with several aspects of weedicide application, are discussed and illustrated in this article.

Interest in the use of large scale spraying equipment for the control of weeds and crop pests has developed only in recent years in Queensland. Consequently data from local experience on which to base conclusions are limited. However, at this stage it is considered that a summary of useful information on large-scale spraying methods and equipment, particularly in relation to weed control in cereal crops, would be of value to the farming community generally.

For the purposes of this article it has been necessary to draw liberally upon information presented in the following papers:—"Chemical Weed-Control Equipment," by Norman B. Akesson and W. A. Harvey (University of California Agricultural Experiment Station Circular 389), and "Chemical Methods of Weed Control," by P. B. Lynch (New Zealand Journal of Agriculture, November, 1948). Acknowledgement is also made of the courtesy of several firms who have made available information on their respective units, which is presented in the following pages.

WEEDICIDES SUITABLE FOR USE IN GRAIN CROPS.

A satisfactory weedicide for use in grain crops must be selective in action—that is, it must be capable of killing weeds in various crops without destroying or seriously harming the crop itself. Two such types of weedicides are available—synthetic growth-regulating substances (or hormones), and one based on dinitro-ortho-cresylate (D.N.O.C.), a basic dyestuff made from coal tar.

When applied in more than minute amounts to certain plant species, hormones upset the normal rhythm of plant growth and development, causing effects ranging from slight distortion of leaves to death of the entire plant. The fact that members of the grass family possess a high degree of tolerance towards hormone weedkillers enables such weedkillers to be used in pastures, in lawns and in cereal crops for the control of susceptible broad-leaved weeds.

There is a variety of types of hormone weedkillers, most of which have a 2, 4-D (2, 4-dichlorophenoxyacetic acid) base. Many commercial preparations are available in Queensland in liquid and powder form.

The D.N.O.C. preparations, one of which is sold in Queensland as "Dinoc," have a different reaction from the hormones on plant life and are not satisfactory against such a wide range of weeds. Furthermore, D.N.O.C. materials are more expensive than hormone preparations and their suitability for low volume spraying is still open to doubt.

However, mention of D.N.O.C. weedkillers has been made because of the susceptibility of buckwheat (*Polygonum convolvulus*) to D.N.O.C. compounds. This weed pest in wheat crops on the Darling Downs is generally resistant to the hormone weedicides. The economics and field scale practicability of using D.N.O.C. to control buckwheat in winter cereal crops have not yet been investigated in Queensland.

LOW VOLUME SPRAYING.

Large-scale spraying equipment in general use is capable of applying amounts ranging from 5 to 30 gallons per acre. This range appears to be quite satisfactory for the present method of weedicide application. However, recent investigations in other countries have shown that, by increasing the concentration of the weedicide and decreasing the volume of spray application per acre, satisfactory weed control results can be achieved in some instances. This finding has directed particular attention to the construction of units capable of applying low volume quantities of from 1 to 6 gallons per acre at low spray pressures. Nozzles designed for this purpose have been produced in America. These low application rates also come within the scope of some recently designed Australian spraying units.

The advantages of low volume spraying in comparison with high volume spraying may be summarised thus: the method is less expensive; less water is required; there is less weight in the appliance and crop damage is reduced; faster spraying may be achieved, and it is possible to use spraying methods on land where it is difficult to spray ordinarily with a machine or where available water supplies are limited.

Certain disadvantages, however, are associated with low volume spraying, the chief of which is increased spray drift of the fine mist-like spray produced. In units employing fine nozzles the spray materials must be completely dissolved or they will not pass through the nozzles.

This means that certain weedkillers applied as suspensions cannot be applied satisfactorily through low volume nozzles. Moreover, in the case of weed growth in tall crops, or with bushy plants, where spray needs to be applied with considerable force to reach all parts of the plant or to the weeds at ground level, satisfactory penetration is unlikely to be secured with low-pressure spraying.

As yet, insufficient data are available on low volume spraying to recommend its general use, but growers contemplating the purchase or construction of a spraying unit should, perhaps, take into consideration the future practicability of this form of spray application. It is pointed out, however, that many present-day units are capable of applying quantities as low as 10 gallons per acre at reasonable speeds. Therefore, such units should be satisfactory as it is probable that, where low volume spraying is practicable, the spray concentration can be adjusted satisfactorily to the slightly increased rate of application per acre and still give good results.

EFFECT OF HORMONE WEEDKILLERS ON CROPS.

Wheat, Oats and Barley: Hormone weedkillers may be used to control susceptible weeds in these cereal crops at quantities up to 1 lb. per acre acid equivalent. Treatment should not be undertaken during the very early stages of crop growth, preferably not before the six-leaf stage.

Linseed: Varying plant effects have resulted from spraying linseed with hormone weedkillers. To avoid any likelihood of plant damage, it is recommended in the light of insufficient experience at this stage that linseed crops be sprayed *only when between 4 and 7 inches in height.* It appears likely that some ill effects may result if the plants are sprayed before or after this period.

Oil based sprays must not be used for treating this crop.

Maize, Millets and Sorghums: These crops are generally resistant to hormone weedkillers in water solution at concentrations up to ½ lb. per acre acid equivalent. Applications of the latter amount may cause such irregularities as the appearance of adventitious roots on the lower portion of the plant stem, but it is not expected that there will be any adverse effect on crop yields.

Sunflowers, Lucerne and Field Peas: These crops are liable to severe damage and should not be sprayed with hormone weedkillers.

Pasture Plants: Grasses past the seedling stage are generally very resistant to hormone weedkillers in moderate applications.

EFFECTS OF D.N.O.C. WEEDKILLERS ON CROPS.

A moderate application of D.N.O.C. is 1 lb. of the active constituent plus 1 lb. sulphate of ammonia per acre, the latter being of value in its role as an activator.

Wheat, Oats and Barley: Resistant to moderate applications and may be safely sprayed.

Linseed: As with hormone weedkillers and until further investigation are completed, it is recommended that linseed be treated only in the 4-7 inch stage.

Lucerne: When young, lucerne is liable to severe damage, but stands 4 to 6 weeks old are fairly resistant. However, at all times extreme caution must be exercised in the treatment of lucerne stands with D.N.O.C. sprays.

Maize: Maize is resistant to moderate applications.

D.N.O.C. sprays are much more effective on weeds in the seedling stage but are also liable to damage crop plants if these are sprayed before becoming well established.

EFFECT OF HORMONE WEEDKILLERS ON MAJOR WEED PESTS OF WINTER AND SUMMER GRAIN CROPS.

The major weeds of Darling Downs crops are listed in classes according to their susceptibility to hormone weedkillers. It is stressed that these classifications are very broad, because factors such as weather conditions and stage of growth may cause a different reaction from that stated in this list.

(*a*) *Susceptible plants*:

Wild turnips (including *Raphanus raphanistrum* and *Rapistrum rugosum*).

Bathurst burr (*Xanthium spinosum*).

Noogoora burr (*Xanthium pungens*).

Hexham scent (*Melilotus indica*).

Bindweed (*Convolvulus arvensis*).

Dock (*Rumex* sp)*.

Mint weed (*Salvia reflexa*)†.

Khaki weed (*Alternanthera repens*)†.

Chickweed (*Stellaria media*)†.

Stagger weed (*Stachys arvensis*)†.

(*b*) *Resistant plants or those in which percentage kill is variable*:

Fat hen (*Chenopodium album*).

Buckwheat (*Polygonum convolvulus*).

Mexican poppy (*Argemone mexicana*).

Galvanised burr (*Bassia birchii*).

Fumitory or Pinkeye (*Fumaria parviflora*).

Datura (*Datura stramonium* and *Datura ferox*).

Nut grass (*Cyperus rotundus*).

CONTROL OF WILD TURNIPS IN CEREAL CROPS.

Wild turnips belong to a family of plants particularly susceptible to even light applications of hormone weedicides. The selective nature of these agents makes the destruction of the turnip pest in cereal crops a simple matter. Farmers have been quick to recognise this fact and over the past two seasons considerable areas of turnip-infested cereal crops have been successfully treated on the Darling Downs.

Experience has shown that the wild turnip plants can be killed at all stages of growth, but generally the most effective treatment is that given when the plants are young and leafy. A spray mixture of 1 lb. acid equivalent with 100 gallons of water is generally regarded as sufficient to treat approximately 6 acres.

* More than one spraying may be required.

† Preferable to spray in seedling stage.

Material applied at the rate stated will cost about 2s. 6d. per acre at present prices. Other treatment costs, such as labour, petrol and plant depreciation, are relatively light, due to the fact that under normal working conditions it is possible to cover approximately 20 acres per hour with a spraying machine of moderate size.

CLEANING SPRAYING EQUIPMENT.

Where the spraying unit is used for both weed and insect pest control purposes it may happen that the crop to be treated with insecticides is one susceptible to hormone sprays. In this case it is necessary to thoroughly clean the unit prior to use, for even a small residue of hormone weedicide is potent enough to damage sensitive plants.

In California, where very large acreages are sprayed, the following recommendations are made:—

For oil-soluble 2,4-D, rinse the tank first with kerosene. Follow with a rinse of washing soda solution (1-2 lb. to 25 gallons of water). Leave the solution in the tank for about 5 minutes. Rinse several times with water, preferably hot. For water-soluble 2,4-D, first rinse the tank with water, then soak the whole liquid-carrying part of the equipment overnight, or longer, in water. Drain, and run washing soda solution through the machine. Rinse thoroughly, using hot water if possible. Even after the above precautions have been taken it is wise to test the sprayer first on very sensitive plants, such as tomatoes, before embarking on large-scale spraying of susceptible crops. If the tomato plants are unaffected after two days, then the spraying unit can be used with safety.

SPRAYING UNITS.

Each of the spraying units described in the following pages fulfils the requirements of a satisfactory unit for use in large-scale cereal crop operation, though not necessarily for low-volume application.

1. Marino Hormone Spray Plant.
2. P.M.S. Boom Spray.
3. Wilmist Sprayer.
4. Buzacott-Wolseley Spray Plant.

Marino Hormone Spray Plant.

In the main this plant (Plates 63 and 64) consists of a 1 h.p. 4-cycle petrol engine and a rotary pump with inbuilt relief valve which can be set to deliver pressure from 20 to 35 lb. per square inch. A 30-ft. boom fitted with 12 nozzles is the normal equipment, but a boom of any length can be supplied on request. To facilitate non-operational travelling this boom can be speedily removed by loosening three thumb screws.

In addition to the main intake strainer, each nozzle is also fitted with a strainer. Varying size of spray discs provides an output control ranging from 10 to 15 gallons per acre at 4 miles per hour.

The outfit includes a hand spray complete with quick release gun, rod, spray nozzle and required hose. All main connections of the unit are made of rubber so that the machine can be speedily assembled and dismantled.

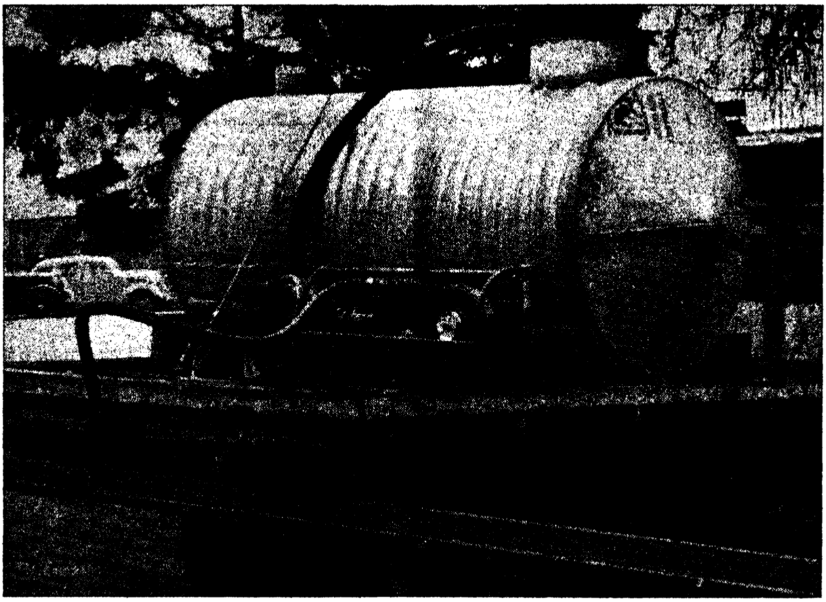


Plate 63.
MARINO HORMONE SPRAY UNIT.

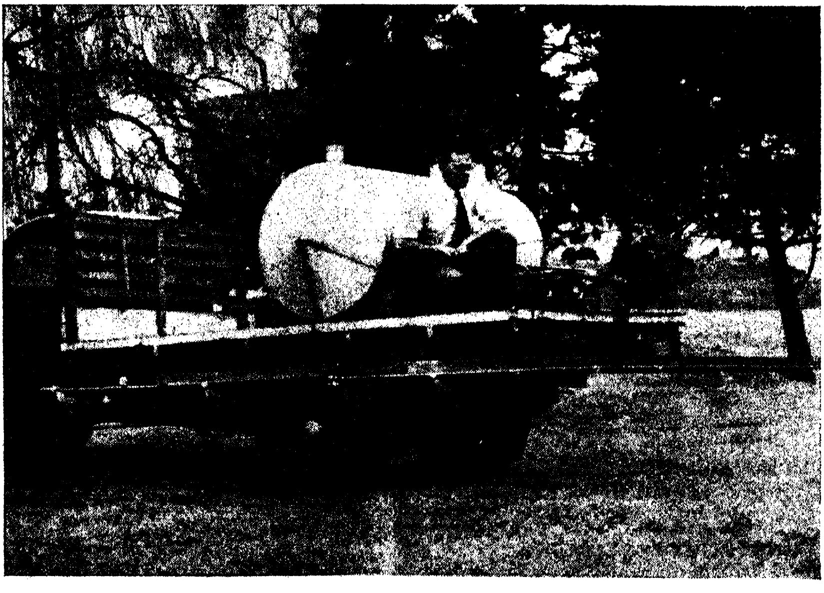


Plate 64.
MARINO HORMONE SPRAY UNIT.

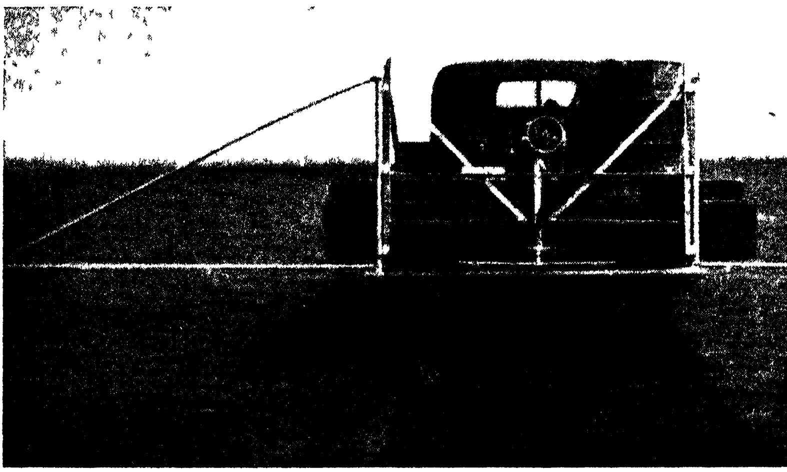


Plate 65.
P.M.S. BOOM SPRAY.

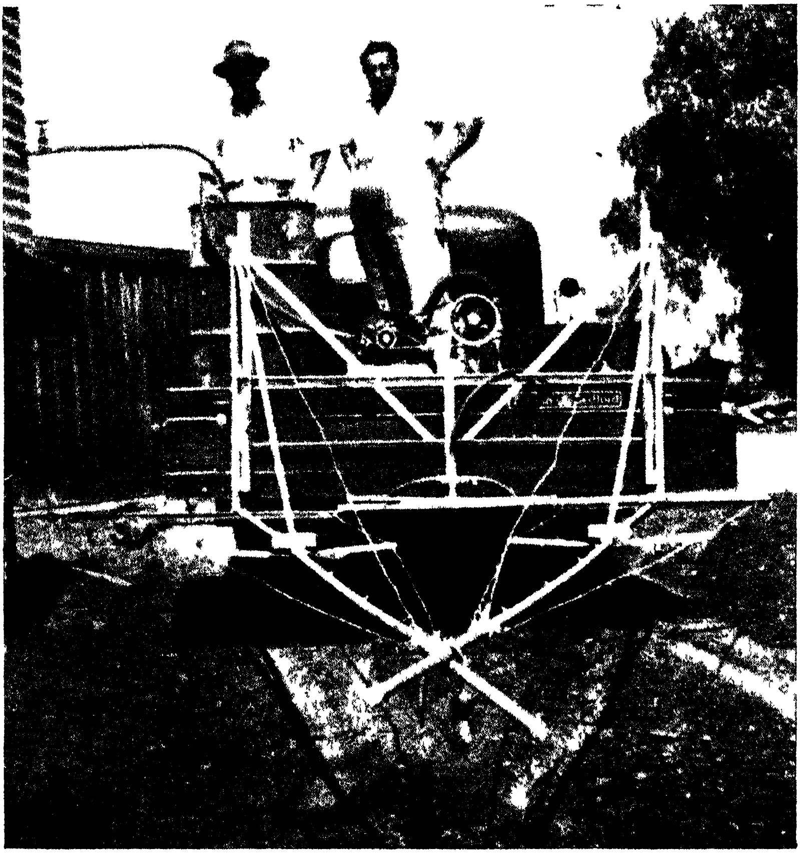


Plate 66.
P.M.S. BOOM SPRAY, SHOWING BOOM FOLDED FOR NON-OPERATIONAL TRAVELLING.

P.M.S. Boom Spray.

This unit (Plates 65 and 66) is supplied with booms 20 ft., 40 ft. or 60 ft. in length, the 60-ft. boom spray being mounted on a pneumatic-tyred trailer carrying a 200-gallon tank. On all models the boom can be quickly raised or lowered for crop height, and can be folded forwards or backwards for transport.

The unit is powered by a 1 h.p. or 2 h.p. 4-cycle petrol engine. The 60 ft. unit operates on its own engine or on the power take-off from the tractor.

Two strainers are fitted into the machine, one between the inlet and the filling tank and the other between the tank and the boom. The nozzles can be readily screwed off should blockages occur.

At 5 m.p.h. with standard type nozzles, 12 to 15 gallons of spray per acre are applied.

Other features of the unit include a brass gear pump and a hand spotting gun.

Plate 67.
WILMIST SPRAYER.

Wilmist Sprayer.

The "Wilmist" (Plate 67) is a compact unit working on an entirely different principle from the common boom sprayers. The spraying solution is forced under low pressure through jets at the mouth of a wind tunnel, where it is spread by a strong blast of air formed by a propellor at the rear of the tunnel. This propellor is enclosed in a bath of oil.

With three varying sized jets, applications ranging from 5 to 15 gallons per acre can be obtained travelling at a rate of 5 miles per hour. This spray has a coverage of about 30 to 40 feet.

The unit is powered by a 3½ h.p. 2-stroke Commando engine which can be disengaged quite simply and used for other farm purposes. Both vertical and horizontal movement of the wind tunnel can be regulated.

Buzacott-Wolseley Spray Plant.

The Buzacott-Wolseley (Plates 68-71) is a highly efficient machine capable of applying amounts varying from 1 to 25 gallons per acre. The spray liquid is fed through a conventional boom to a series of spinning cones which throw the spray out in the form of a mist. Each cone is driven by a small electric motor which draws its power from a heavy duty battery continually charged by a generator. Plate 70 illustrates a single motor and cone.

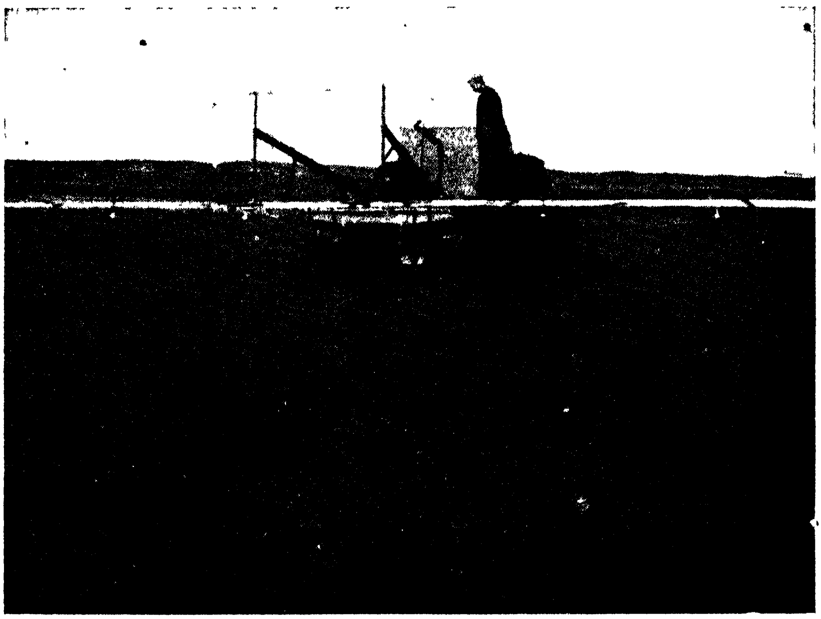


Plate 68.

BUZACOTT-WOLSELEY SPRAYING UNIT.

Cones are spaced at intervals of 6 feet along the boom and therefore the cost of these spraying plants is roughly in proportion to the length of boom.

Although a Buzacott-Wolseley spraying unit with a boom 30 ft. in length would be much more expensive than other types of sprayers giving a similar coverage, the unit has the advantage of giving extremely low volume applications with little likelihood of blockages, as the smallest orifice through which the spray liquid passes is $\frac{3}{8}$ inch.

INFORMATION ON FARM-BUILT SPRAYERS.

For the benefit of farmers contemplating building their own spray outfits, information on various points to be considered is set out hereunder. Acknowledgment is made of papers on chemical weed-control equipment by N. B. Akesson, of the University of California, which have been liberally drawn upon. The discussion refers to conventional weed-killing equipment and not specially to low volume-low pressure spraying or to unusual types such as the "Wilmist" and the "Buzacott-Wolseley."

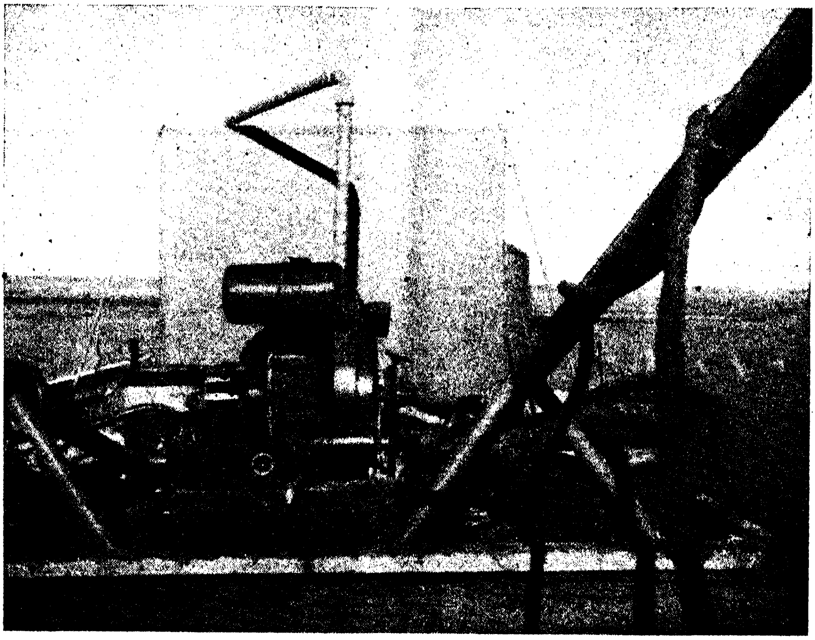


Plate 69.
POWER UNIT OF BUZACOTT-WOLSELEY SPRAYING PLANT.

Pumps.

The most important item to be considered when building a power sprayer is the pump.

It is possible to buy almost every type of pump in combination with an engine, both mounted on a single base and designed as a unit. These are more satisfactory for spray outfits than a pump powered by an auxiliary engine or the power take-off drive from a tractor. For a power take-off driven spraying unit, the pump may be mounted on the tractor, while the tank and boom are on a trailer; or pump, tank and boom may be carried on the tractor and the pump driven either directly from the power take-off or from the belt pulley. A spray unit with an auxiliary engine has an advantage over the power take-off because the auxiliary's speed can remain constant regardless of changes in the tractor's speed. The important point in choosing either the auxiliary or power take-off drive is to select a drive which will maintain the pump at sufficient speed for the necessary pressure.

Where one piece of spraying equipment is to be used for several different jobs, such as orchard and weed spraying, a high-pressure pump is practical. The pressure may be lowered for weed spraying with the by-pass valve or pressure regulator. If the equipment is to be used for weed spraying only, a high pressure pump is not necessary, since a maximum nozzle pressure of 75 to 125 pounds per square inch is adequate.

Centrifugal pumps of single, two-stage or multi-stage design are commonly used for weed sprayers. In order to produce sufficient pressure, centrifugal pumps must operate at relatively high speeds

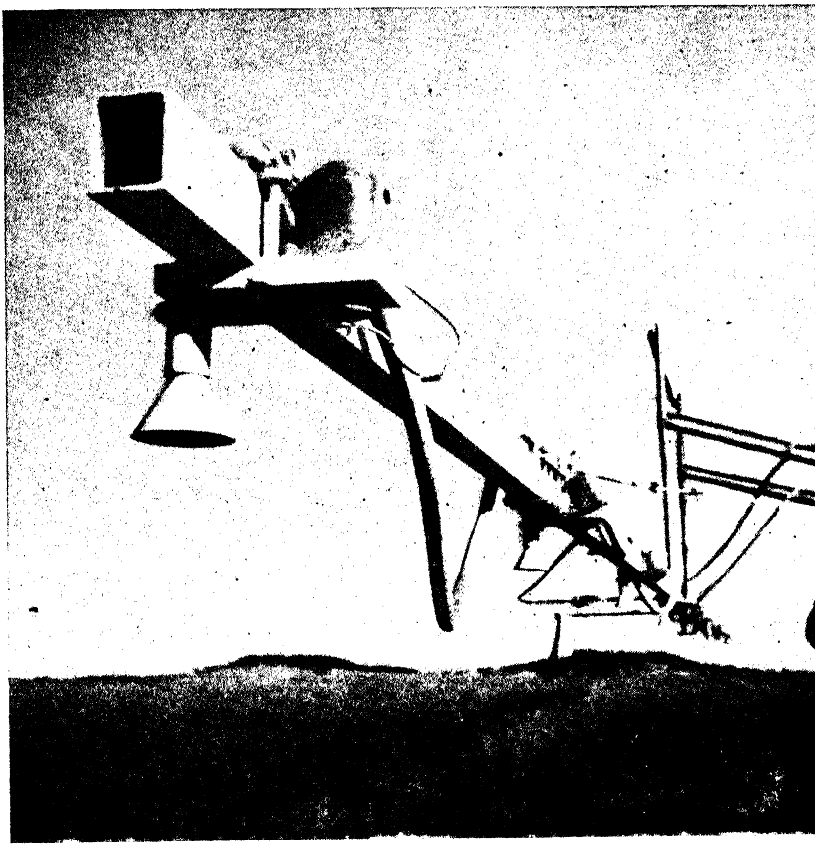


Plate 70.
BUZACOTT-WOLSELEY SPRAYING UNIT WITH BOOM FOLDED TO FACILITATE ELECTRIC MOTOR.

(3,000 to 3,600 r.p.m.). Power for maintaining these speeds is usually supplied by a petrol engine. A common design is a single-stage centrifugal pump attached directly to a single-cylinder, air-cooled engine. Higher pressure can be obtained at the same pump speed or the same pressure at lower speed by using a two-stage or multi-stage type, consisting of two or more centrifugal pumps mounted on a single shaft in the same housing. With this type pump, speed may be regulated for high or low pressures.

The power requirement for many centrifugal pumps is greatest at zero pressure and maximum discharge. The engine should be large enough to supply the necessary power without being overloaded. A commercially built pump and engine unit will either be designed to prevent overloading, or it will have instructions showing maximum operating time at full discharge.

Centrifugal pumps are not positive displacement types and no harm is done by closing the discharge while the pump is in operation.

Centrifugal pumps do not require by-pass pressure regulators or relief valves. Pressure may be controlled by a diaphragm type pressure reducing valve or by opening the control valve.

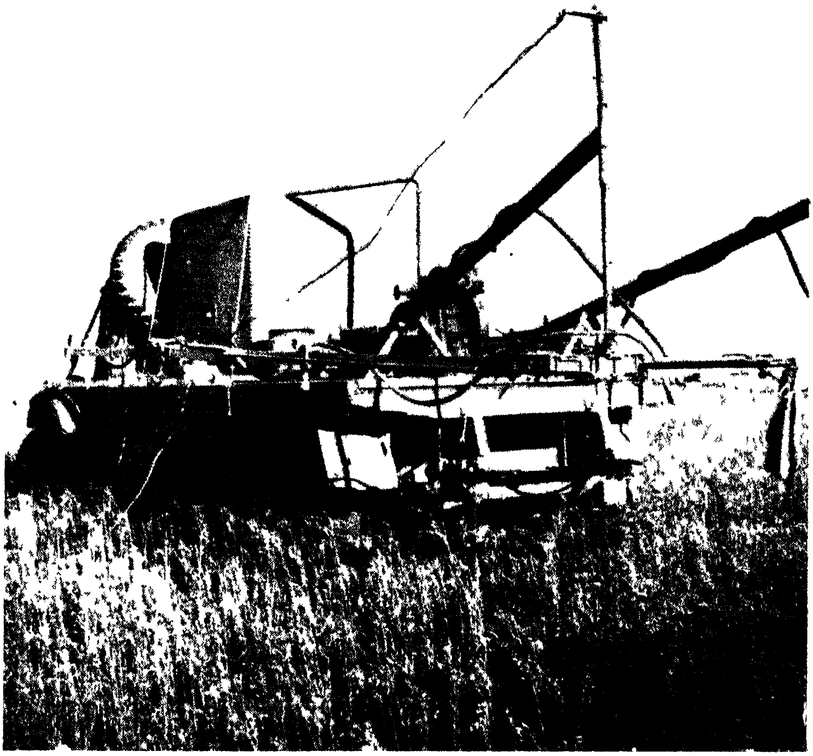


Plate 71.
BUZACOTT WOLSELEY SPRAYING UNIT WITH BOOM FOLDED TO FACILITATE NON-OPERATIONAL TRAVELLING.

Rotary gear pumps with either external or internal flow are also used for weed spraying. They are a positive displacement type and do not need priming but do need a by-pass valve or pressure regulator to relieve the pump when the spray nozzles are shut off.

Information on pumps suitable for spraying purposes may be obtained from the manufacturers.

Tanks.

Metal tanks are preferable to wooden ones because they are easier to clean and less likely to leak. The tank should have a large opening at the top for easy cleaning and care of the agitator.

The size of the tank depends somewhat on the capacity of the pump, on whether concentrated or diluted sprays are to be used, and on nearness to water supply. In general, if water is readily available a 300-500 gallon tank is large enough.

Some tanks are galvanised, some are enamelled and others are left bare. Bare tanks have a tendency to rust, but this may be reduced by carefully draining the tank after each use and flushing it with rust-preventive oil or cylinder oil.

Agitators.

A tank to be used for straight oil sprays alone does not require an agitator, but for all mixed sprays agitation is necessary. With oil emulsions and heavy suspensions, the agitator must be kept running constantly. With hormone sprays, only light agitation is needed.

Mechanical agitation is generally more efficient than hydraulic agitation. It is achieved by a series of paddles mounted on a shaft which runs through the spray tank and is driven by a reduction drive from the pump engine. The ends of the paddle blades should have a total width about equal to one-half the length of the tank (that is, 4 blades each 8 in. wide in a 60-inch tank). The blades should sweep within ½ inch of the tank bottom.

Hydraulic agitation requires no moving parts in the spray tank. The excess flow at boom pressure is re-circulated to the spray tank and forced out through many small openings in a 1- or 2-inch pipe laid in the tank bottom and sometimes fitted with nozzles. About 25 gallons of agitation flow at 100 lb. per sq. in. is recommended for a 3-foot diameter, round bottom 200-gallon tank and about 33 gallons for a flat bottom tank. This extra flow must be added to the boom requirement when the pump is bought.

Refilling.

The pump and motor may be used to refill the tank with suitable backfill equipment. Care should be taken to reduce picking up dirt or gritty water from irrigation ditches or wells by providing a large strainer on the suction line.

Booms.

Spray booms are generally made of 1-in. to 2-in. pipe. Galvanised or black iron, aluminium and other light metal pipes have been used. The 1-in. size is sufficient for a 15 ft. boom; 1¼ in. or larger is recommended for larger booms. Smaller pipe is not practicable because of both the resistance to liquid flow which the small pipe presents and the greater tendency to whip and buckle, particularly in the long boom. Also, it is easier to cut holes in the larger diameter boom and mount the nozzles. Supports must be provided for the boom, generally in the form of chain or cable for vertical support and rods to maintain lateral strength. The boom must be mounted to allow variable height adjustment, and supports must be easily changed to co-ordinate with these adjustments. For ditch bank or roadside work, the boom may be mounted entirely on one side of the rig. Boom tips or the entire boom on one side of the rig may be hinged and provided with a spring return to reduce breakage caused by catching the boom on gates, posts and other obstructions. The boom is generally in two or three sections which may be folded up or back for convenience in moving on roads and through gates.

Nozzles are brought into the boom from the top or side by means of welded nipples or couplings. This leaves a settling space in the boom for dirt particles and also keeps the boom from draining when the main control valve is shut off. Some operators are using small spring loaded ball valves on each nozzle which open when the pressure exceeds 5 lb. per sq. in. and close when the boom valve is closed and the pressure drops below. Another recent development is the reversing valve which places a suction on the main boom line when the main valve is shut off and draws liquid back from the nozzles into the boom. The suction is provided by discharging the flow from the pump through a venturi or

jet when the boom is shut off. A four-way valve makes it possible to combine the main boom valve and the suction valve in one, and the two operations may thus be taken care of by this one valve.

A good quick shut-off valve should be provided in the main boom line. Several manufacturers are using a spring loaded poppet type valve with eccentric and lever. This type may be opened or closed merely by pulling a jerk line from the tractor operator's seat. A screen should be placed in the boom line to reduce nozzle clogging; and when using small nozzles, an additional set of screens is most convenient for the boom line, eliminating the necessity of pulling the screen apart for cleaning.

Hand booms are best made of light metal alloys instead of the usual ¼ in. or ⅜ in. iron pipe. The most convenient valves are those which can be operated by squeezing the valve lever against the boom with one hand. When the lever is released, a spring closes the valve. The usual provision is for 25 to 50 feet of oil resistant hose to supply one or two nozzles on the hand boom.

Nozzles.

Nozzles producing a flat fan discharge are generally considered to give most uniform coverage and strongest drive. Cone discharge nozzles are used by some manufacturers for the very fine nozzles, greater uniformity of discharge being the reason for this practice. Nozzles are made either with a removable tip and strainer, or the tip and body may be formed as a unit. Approximately 10 to 20 lb. per sq. in. are required to make the flat fan nozzle "fan out" or disperse properly. Greater pressure increases the discharge and decreases the droplet size. For this reason, a low pressure of only 15 to 30 lb. per sq. in. is recommended on the fine nozzle to prevent fuming and drift due to the small droplets. Higher pressure also increases the drive or penetrating quality of the nozzle discharge to a certain point, after

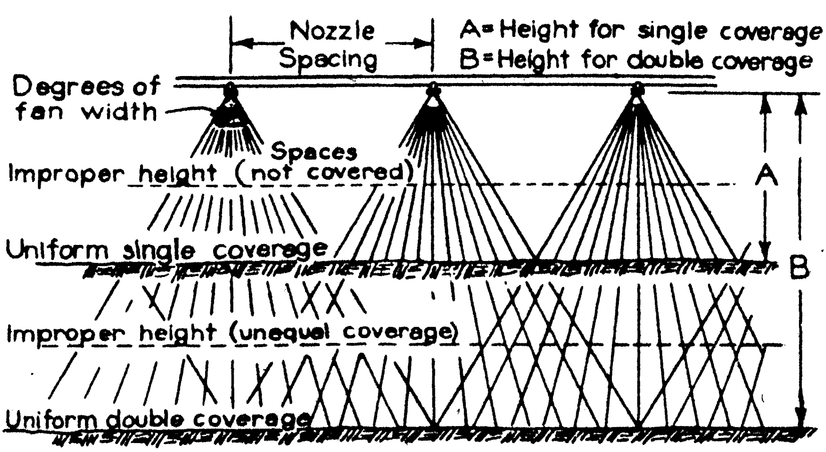


Plate 72.

SHOWING CORRECT HEIGHT OF BOOM FOR PROPER SINGLE AND DOUBLE COVER AND RESULTS OF IMPROPER BOOM HEIGHT.—Note that double coverage does not increase the amount of spray applied per acre.

which the resulting smaller droplets reduce the drive. This is an important feature when general contact work is being done in rank weed growth.

Nozzles may be arranged all on one side of the boom; or as is frequently done, alternate nozzles are placed on opposite sides of the boom and slanted toward one another; and double coverage as shown in Plate 72 is used. Double coverage does not increase the gallons per acre used but causes each swath to be hit by two nozzles in place of one and thus reduces the chance of skipping or leaving a portion of a swath uncovered when operating on rough ground and over irrigation checks.

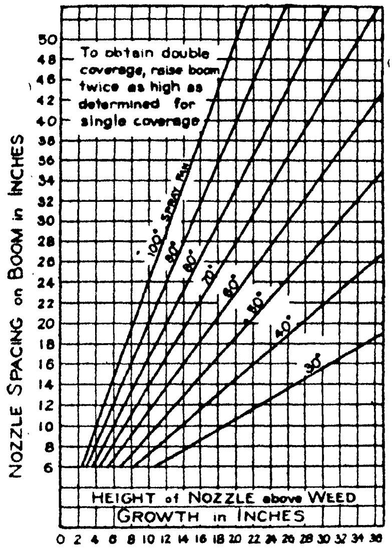


Plate 73.

CHART SHOWING HEIGHT OF NOZZLES ABOVE WEEDS REQUIRED TO GIVE SINGLE COMPLETE COVERAGE FOR 6 TO 48 INCH NOZZLE SPACING ON BOOM, AND VARIOUS NOZZLE SPRAY FAN WIDTHS.

The nozzle height to obtain single or double coverage with different nozzle spacing on the boom is shown in Plates 72 and 73. The proper boom height is always as low as can be used with the nozzles available so as to reduce possibilities of drift and skipping. Increased pressure widens the fan angle. Thus, the boom height may have to be changed when pressure is altered.

Calibrating the Sprayer.

One of the most important considerations in the design of a spray rig is the requirement of the spray job to be done. Suggested volumes and pressures for various spray applications may be summarised roughly as follows:—

(1) Selective oil sprays in carrots: 35-70 gallons per acre at 40-80 lb. per sq. in.

(2) Selective sprays in cereals, onions and linseed: 2 to 100 gallons per acre at 20-100 lb. per sq. in., including low-volume application of hormone weedkillers.

(3) General contact spraying (as for Johnson grass): 80-350 gallons per acre at 75-150 lb. per sq. in.

These recommendations show the wide range of pressure and volume to be expected in normal weed spraying.

The number of gallons per acre a sprayer will discharge depends on:—

(1) Ground speed. An accurate check on tractor speed can be made by timing tractor and rig over a measured length of the field.

$$\text{m.p.h.} = \frac{\text{No. of feet travelled}}{\text{No. of seconds}} \times \frac{682}{1{,}000}$$

With most tractors, 4 m.p.h. is a convenient speed.

(2) Nozzle pressure. This should be kept within the recommended range for various types of spraying as mentioned above.

(3) Nozzle spacing. This is chosen to fit in best with the spray jobs to be done.

(4) Size of nozzle opening. It is possible, with a set of different nozzle sizes, to vary the gallons per acre over wide limits with only minor changes in speed and pressure.

(5) Amount of active ingredient in the spray mixture. This can be changed by adding water or oil.

Plates 74 and 75 can be used to determine (*a*) the right size nozzle for a particular spray application, (*b*) the number of gallons per acre which a nozzle of known discharge rate will apply at various speeds; and (*c*) the speed of travel to apply a required gallonage with nozzles of known capacity.

For example, if it is desired to obtain the nozzle discharge required to have a 80 gallon per acre application made at 5 m.p.h. and nozzle spacing of 18 inches, refer to Plate 75, which gives a reading of 73 gallons per hour or about 1.25 gallons per minute per nozzle. For 12-inch spacing, multiply the figure by 0.66, and so on.

Spray fan widths are also given in the manufacturers' catalogues in degrees at stated pressure for each nozzle. By consulting Plate 73 the correct boom height can be found with a given nozzle spacing and for the fan width produced by the nozzle at the pressure used.

It may be useful to determine the exact output of the sprayer after the nozzles have been installed, and the rig is ready for operation. The nozzle discharge data are based on water and will increase as oil is added to a maximum of 20 to 30 per cent. increase on straight oil. A check can be run on the sprayer, to see if the calculation made and the nozzles chosen are correct, by operating the machine standing still and measuring the actual discharge in a pint container for a given time. A rough check in the field can be made by the use of a calibrated tank or by carefully measuring the amount required to refill the tank at the end of two or three rounds when a known acreage has been covered.

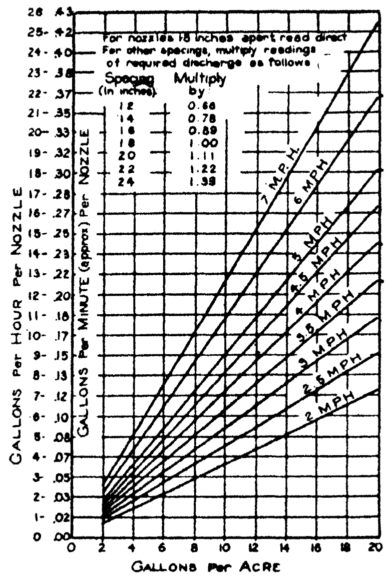


Plate 74.

CHART SHOWING DISCHARGE PER NOZZLE TO GIVE 2 TO 20 GALLONS PER ACRE AT VARIOUS FIELD SPEEDS.—Note that when using this chart with nozzle spacings other than 18 inches, the gallons per minute or hour found must be multiplied by the proper factor as shown, and when the chart is used to find gallons per acre and m.p.h. the answers must be divided by the correction factor.

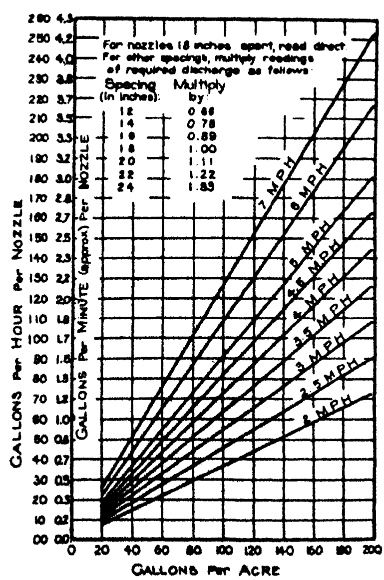


Plate 75.

CHART SHOWING DISCHARGE PER NOZZLE TO GIVE 20 TO 200 GALLONS PER ACRE AT VARIOUS FIELD SPEEDS. (See noting to Plate 74.)

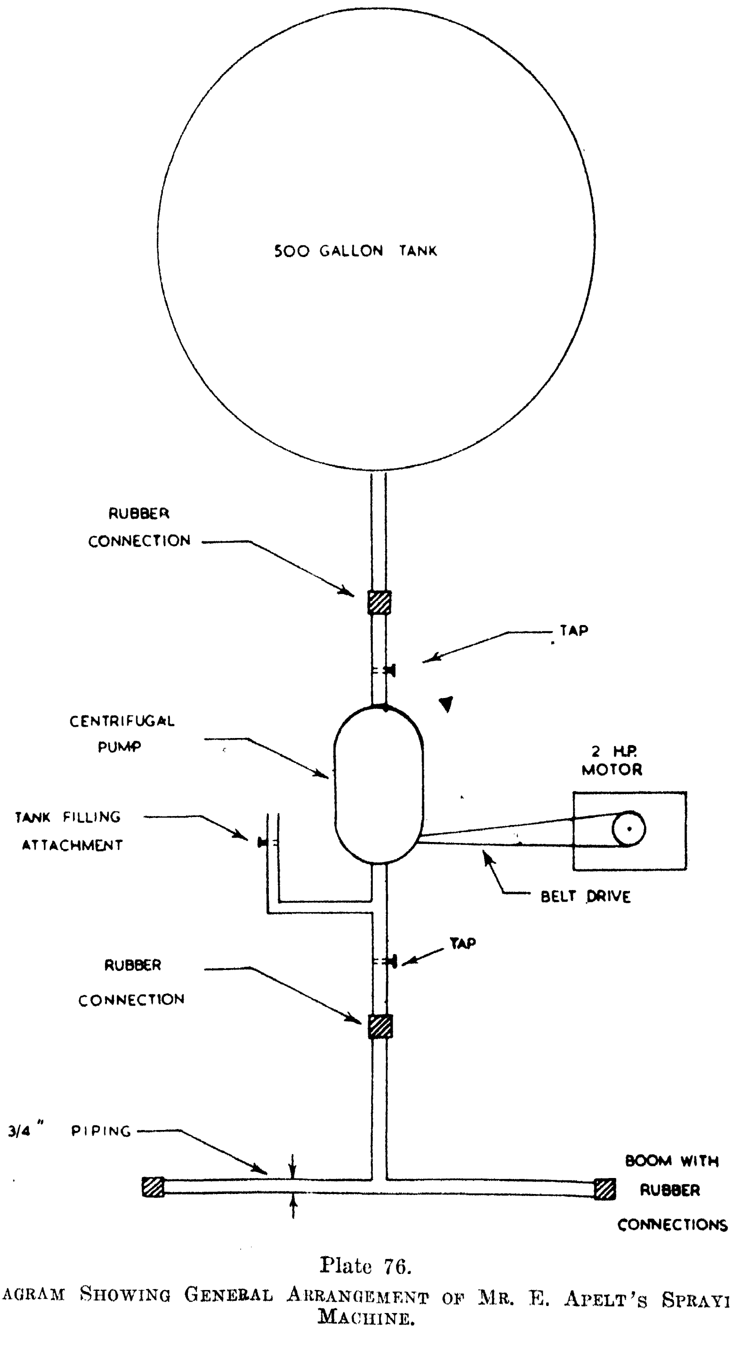


Plate 76.
DIAGRAM SHOWING GENERAL ARRANGEMENT OF MR. E. APELT'S SPRAYING MACHINE.

HOME MADE SPRAYING UNIT CONSTRUCTED BY Mr. E. APELT, YARGULLEN.

This unit is simple in construction and has proved effective for wild turnip weed control. The diagram shown in Plate 76 together with the photographs (Plates 77-79) will be of assistance to any grower desirous of building his own spray outfit.

Plate 79 shows the unit with boom folded to facilitate travelling when the machine is not in operation. This is made possible by breaking the rubber connections at the centre of the boom and allowing each half of the boom and boom support to swing forward.

Materials and Cost.

These figures were kindly made available by Mr. Apelt. Costs shown were ruling prices at time of construction (1949).

	£	s.	d.
(1) Galvanised iron tank—500 gallons	8	0	0
(2) Centrifugal pump (1-inch intake, $\frac{3}{4}$-inch outlet) ..	5	0	0
(3) 3 only $\frac{3}{4}$-inch water taps		14	0
(4) 52 feet of $\frac{3}{4}$-inch galvanised iron piping		16	2
(5) No. 9 nipples (Bordeaux spray jets No. 11-01) ..		17	3
(6) Short lengths 1-inch hose		4	0
(7) 8 hose clasps		2	4
(8) Angle iron for main support and boom (including welding costs). Main support 3 inches; side braces 1 inch	9	0	0
	£24	13	9

In addition a power unit of at least 2 h.p. is required. Such engines are often a part of normal farm equipment and could be readily converted for use during periods when the spraying unit was needed.

Plate 77.
SHOWING MR. APELT'S HOME-MADE UNIT IN ACTION.

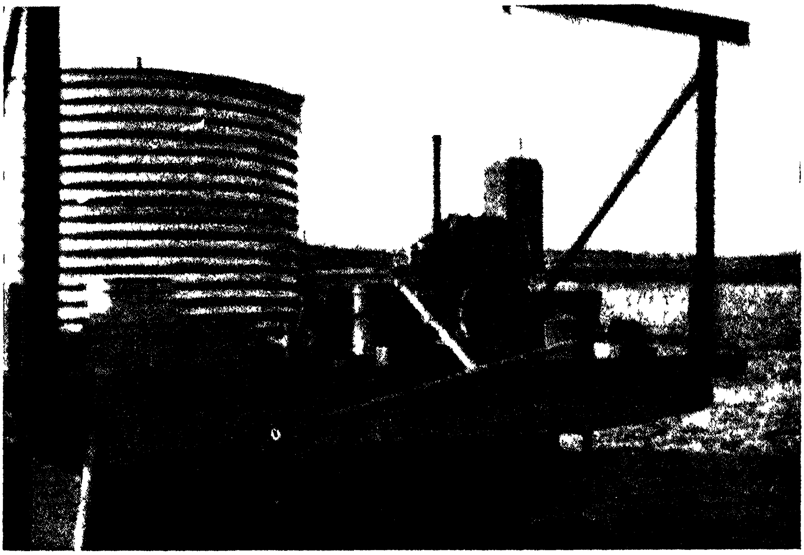


Plate 78

Showing Pumping Unit of Mr E Apelt's Spray Rig with Boom Disconnected

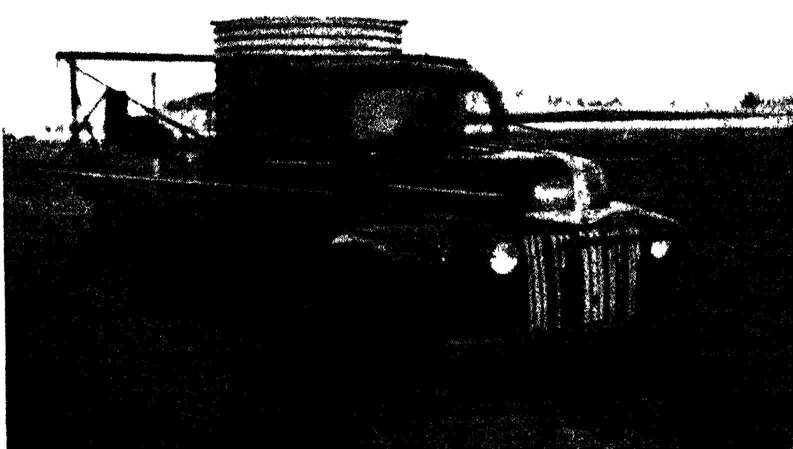


Plate 79.

Showing Mr. Apelt's Unit with Boom Folded for Non-operational Travelling.

Winter Injury to French Beans.

H. M. GROSZMANN, Horticulturist.

FRENCH beans are naturally adapted to summer growing conditions, and in winter will thrive only in the most favoured, frost-free localities. Even where no frost is experienced, prolonged low temperatures or cold, drying winds may adversely affect the plant. This was very evident during July and August of 1949, when two distinct types of winter injury were prevalent throughout the main bean growing areas of southern Queensland.

The first (Plate 80) is distinguished by numerous curved and stunted pods on apparently vigorous plants On examining the beans, it is found that the seed has failed to develop, with consequent dwarfing of the pods. These rarely exceed four inches in length, and as they mature they become hollow and useless. This abnormal condition is caused by temperatures which are not sufficiently low to injure the plant but low enough to prevent normal seed formation. It is most likely to occur on land which is just above normal frost level, and if such land is to grow beans the crop should be planted at such a time that it will not be flowering during July and August. This means avoiding planting in April and May.

The other abnormal condition is marked by the appearance of dead, scorched areas on the leaves. The first symptom is a slight browning of the most exposed leaves and this is followed over a period of several days by death of the area between the main veins, and sometimes of the leaf margin. The veins may remain green for some days. The degree of injury differs greatly from place to place. Often an affected plant will continue to grow and appear little the worse for the damage to a few leaves. In some localities, however, young plantings have died out completely.

While the exact explanation of this scorching is uncertain, the most likely cause is prolonged exposure to very cold winds. Some have suggested actual frosting, but the topographical distribution of the trouble, together with its appearance over a period of several days, scarcely fit in with this explanation. Moreover, in past years, even

when much heavier frosts were experienced, it was not nearly so prevalent as during last July and August, which was a period of prolonged, cold, drying winds.

Where this injury rarely occurs, it scarcely seems necessary to take any precautions against it. Where it occurs frequently, the locality

Plate 80.
WINTER INJURY TO FRENCH BEAN PLANT SHOWING CURVED AND STUNTED PODS.

is not really suitable for winter beans, though in some cases the provision of windbreaks may reduce the damage. Even where scorching does not occur, strong winds often do much damage by breaking the plants and drying out the land, and these adverse effects are generally sufficient to warrant the planting of windbreaks.

Approved Strawberry Planting Material, 1950 Season.

THE Department of Agriculture and Stock proposes to extend its scheme for providing approved strawberry planting material to the 1950 growing season. Nominated crops will be inspected by Departmental officers and at the end of the season the names of growers having an approved source of runners will be published in *The Queensland Agricultural Journal* and *The Fruitgrowers' Gazette.*

Any grower desirous of having his strawberry runner bed approved by the Department of Agriculture and Stock should prepare the information required under the following headings and forward this to the Department not later than 1st May, 1950.

Particulars required:—

(1) Name in full. (2) Address (details). (3) The area of the plot from which it is intended to sell runners. (4) Source of the runners used to plant the crop under consideration. (5) Variety to be planted. (Only the varieties Phenomenal and Aurie may be nominated.)

The strawberry grower will have to be prepared to undertake the following matters relating to his side of the work:—

(1) Plant the area with runners from a source approved by the Department in the previous year.

(2) Keep the plants well cultivated and reasonably clean at all times, including the period from the time the crop finishes to the digging of runners.

(3) Apply such fertilizers, insecticides, and fungicides as may be necessary to maintain the crop in good condition or as the inspecting officers may require.

(4) Rogue out all virus infected and off type plants at not greater than fortnightly intervals or as directed.

(5) Permit the roguing of virus infected or off type plants by the inspecting officer.

(6) Destroy not later than November any strawberry plants on his property other than those subject to inspection for approval.

(7) Supply any information which may be required by an inspecting officer in connection with the approval scheme.

(8) If listed as an approved grower to sell only such runners as are approved.

(9) Make his own arrangements for the sale of his runners.

(10) Furnish a list of all sales in excess of 500 runners not later than 30th April, 1951, to the Department of Agriculture and Stock.

(11) Accept the standards set out below:—

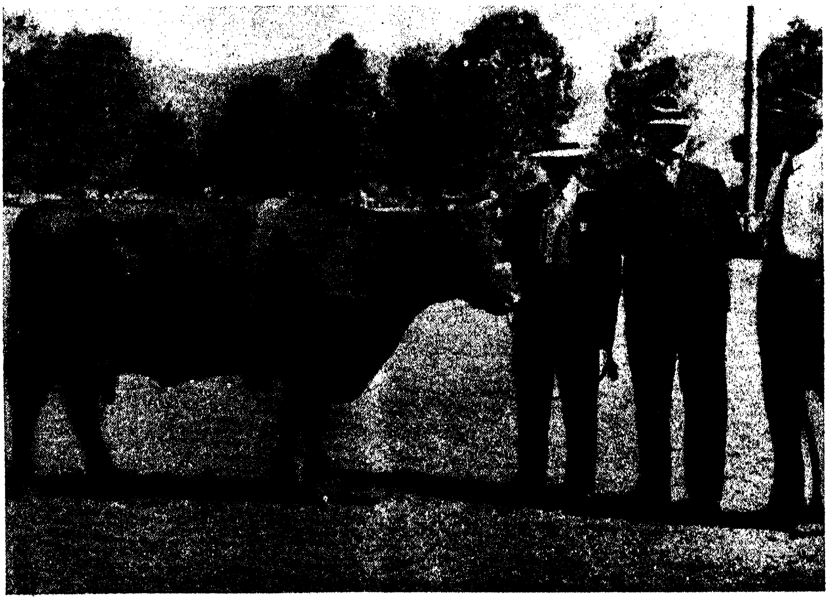
(*a*) At the first inspection (winter) the crop must contain not more than 2 per cent. plants affected with virus diseases.

(*b*) At the time of subsequent inspections the crop must contain not more than 0.5 per cent. plants affected with virus diseases or 5 per cent. plants affected with off-type characters.

(*c*) The crop must, in the opinion of the inspecting officer, be sufficiently well cultivated and free from weeds and pests and diseases in addition to those already mentioned to ensure that the planting material will be of good quality.

The Department of Agriculture and Stock will undertake to inspect strawberry crops for the purpose of determining whether they conform to the standards required for approval. The Department reserves the right to restrict those inspections to the number of crops which can be efficiently handled and to those with a reasonable chance of being successful.

Tableland Milking Achievement.



"Learmont May 3rd" (top) at the Atherton Show last May broke the Ground Milking Competition record for Australia with 85.9 lb. of milk and 3.3928 lb. of butterfat. She bettered these figures at Malanda Show in September, producing 96 lb. of milk and 3.926 lb. of butterfat. "Learmont Jewel" (bottom) won the Junior class at Atherton with 54.8 lb. of milk and 1.8845 lb of butterfat. Both animals are owned by Messrs. P. J. Donaghy and Sons.

The Minister for Agriculture and Stock (Hon H. H. Collins) is shown decorating "Learmont May 3rd" and also congratulating Mr. G. Donaghy on the junior's performance.

The Butter Improvement Service.

L. L. MULLER and L. E. NICHOLS, Dairy Research Laboratory,
Division of Dairying.

IT has long been appreciated that to attain and maintain the highest standard of efficiency in the butter industry, a technical control service in the chemical composition and bacteriological quality of the product is essential.

GENESIS OF THE SERVICE.

The realisation of the necessity for such a service led to the introduction of the Butter Standardisation Service in 1937. Under this scheme a limited number of factories were given detailed chemical and bacteriological information on a fixed number of butter samples each month. During its operation, this scheme emphasised the economic advantages to be gained and paved the way for its application to all factories.

In 1940 the present Butter Improvement Service was instituted.

OBJECTIVES.

The objectives of the Service can be briefly stated as:—

(*a*) To obtain the practical maximum of butter output from a given quantity of butterfat consistent with legal standards.

(*b*) To maintain a uniform level of salting to satisfy consumer demands for an even flavour, and to ensure that the serum brine concentration is sufficiently high to retard bacterial development.

(*c*) To obtain information on the standard of factory hygiene and the principal sources of contamination so that any damaging effect on quality can be diagnosed.

(*d*) To help obtain the best keeping quality.

PROCEDURE.

General.

Of the 53 butter factories at present operating in Queensland, all but seven are covered by the Butter Improvement Service. These seven comprise a group with high production, exporting from Gladstone, which

employ their own technologist and so provide themselves with a similar service using similar media, methods and standards to those used in Brisbane. The other 46 factories, with the exception of four on the Atherton Tableland, send butter for export through Brisbane or supply the Queensland Butter Marketing Board for Brisbane's requirements, so that the butter is available for sampling at the time of grading.

Sampling.

Choice or, if necessary, first grade butter samples from the five most recent churnings of each factory are taken at intervals of about three weeks. These samples are subjected to bacteriological and chemical tests.

Bacteriological Tests.

Plate Count and Casein Digester Count.—This is a method of estimating the number of bacteria present in each gram of the butter and the number capable of digesting milk proteins.

The Presumptive Coliform Test, which indicates the extent of post-pasteurisation contamination.

Yeast and Mould Count.—This is determined by the plate method, using a differential medium which prevents the growth of bacteria but encourages the growth of yeasts and moulds.

A *"Bottle" Test* was formerly included to gain some information on keeping quality, but the method used was found to have some disadvantages and the test was discontinued.

Chemical Tests.

The Moisture and Salt Content of each sample is determined.

pH.—The pH of the butter serum is determined on each churning made from a separate vat of cream. The pH is a measure of the intensity of acidity or alkalinity in the butter and can be related to cream neutralisation in the butter factory.

DESIRED STANDARDS.

Bacteriological.

Standards have been set for the four results obtained, namely:—

(*a*)	Plate count per gram	Less than 100,000
(*b*)	Casein digester count per gram..	5,000 or less
(*c*)	Yeast plus mould count per gram	100 or less
(*d*)	Presumptive Coliform test ..	Negative in 1/10 gram

To stimulate a competitive interest in the results and to give a simple figure that can be used to illustrate how closely a factory's results approach the standard, a *Bacteriological Quality Index* (*B.Q.I.*) is used. Based on the above tests, if the results fall within the standards mentioned 20 points are allotted, thus giving a possible total of 400 points. If the number of samples differs from five the allocation of points to each result is varied accordingly so as to give the same total of 400.

Chemical.

Moisture.—The legal maximum moisture content of butter is 16.0 per cent. and economy demands the closest approach to this figure. However, as penalties exist for butter containing excess moisture, an average better than 15.8 per cent. is difficult to achieve with safety. The results obtained by many factories show that this figure can be achieved in practice without difficulty.

Salt.—The maximum salt content of butter permissible for local requirements is 2.5 per cent. and for export 2.0 per cent. However, 1.5 per cent. appears to satisfy most local demands, while 1.2 to 1.3 per cent. is often asked for in export butter. For these reasons it is difficult to set a definite standard for salt, but 1.2 to 1.5 per cent. is considered a desirable figure.

Points Score.—Again in moisture and salt control the competitive aspect has been recently intensified by the introduction of a points scoring system which is used in quarterly and annual reports for placing the factories in order of merit. Most stress has been placed on the moisture control aspect by allowing 85 per cent. of the points for moisture and 15 per cent. for salt. Because of the varying standards 1.2 per cent. or more of salt is given full points. Full points are given for 16 per cent. moisture, with only slight progressive reductions down to 15.7 per cent. Below this the points fall off more rapidly. The total score possible is 100.

pH.—In accordance with the recommendations of most investigators a provisional range of 6.8 to 7.2 was set for pH to ensure optimum keeping quality.

Since their inception in 1948 the pH results have been providing useful information on neutralisation procedures and accuracy in Queensland factories and have enabled guidance to be given to factories where necessary.

INTERPRETATION OF BACTERIOLOGICAL RESULTS.

From the results of tests on each batch of samples a fairly reliable indication of the principal sources of contamination in the factory can be obtained. High total counts in the absence of casein digesters or coliforms are often due to inefficient pasteurisation, with the resulting survival of large numbers of heat-resistant bacteria.

When casein digesters and coliforms are also numerous, contamination is suspected from such sources as pumps, pipelines, coolers, vats and glands. In some cases coliforms have been found to originate in the factory water supply. The yeast and mould count is practically a direct indication of the sanitary condition of the wooden churns used exclusively in Queensland.

The question of butter texture bears strongly on the interpretation of bacteriological results. Where the butter is underworked, the moisture is distributed rather unevenly, many of the droplets being large enough to support bacterial growth between the time of manufacture and grading. Grading comments are some guide here, as the butter may be underworked when the texture is open or mottle is present, thereby encouraging bacterial growth. However, it is probable that finer distinction is necessary in some cases and it is hoped to include a microscopic examination for the efficiency of working in B.I.S. reports at a later date.

USE OF RESULTS.

When completed, results are forwarded to the factory with appropriate comments and suggestions. A copy is also forwarded to the local field officer, who is directed to check on the reasons for any departure from normal. Quarterly and yearly results are also compiled and circularised to show the seasonal and yearly trends. The recording of results in the laboratory enables a picture of the factory hygiene and chemical control standards to be built up. When results indicate the need, or if a request is received for assistance, the services of a laboratory officer are made available for a survey of the factory. A bacteriological survey performed by examining a series of samples at the factory will usually show the way to remove sources of contamination. Problems of texture or chemical control are also examined in an endeavour to find a solution.

The results of bacteriological surveys of factories in the past have usually shown that attention to the following main points will give an improved B.Q.I.:—

(1) Daily dismantling, thorough cleaning and sterilizing of pipe lines and pumps.

(2) The elimination of dead ends and undue length of piping.

(3) The observance of a strict and intensive churn cleaning and sterilizing routine.

(4) The prompt replacement of worn or pitted equipment.

(5) Chlorination of the factory water supply, particularly the butter wash water. A concentration of 0.5 p.p.m. of chlorine in the water entering the churn has been found effective. Colour standards for the orthotoldine test to check this concentration are supplied to factories.

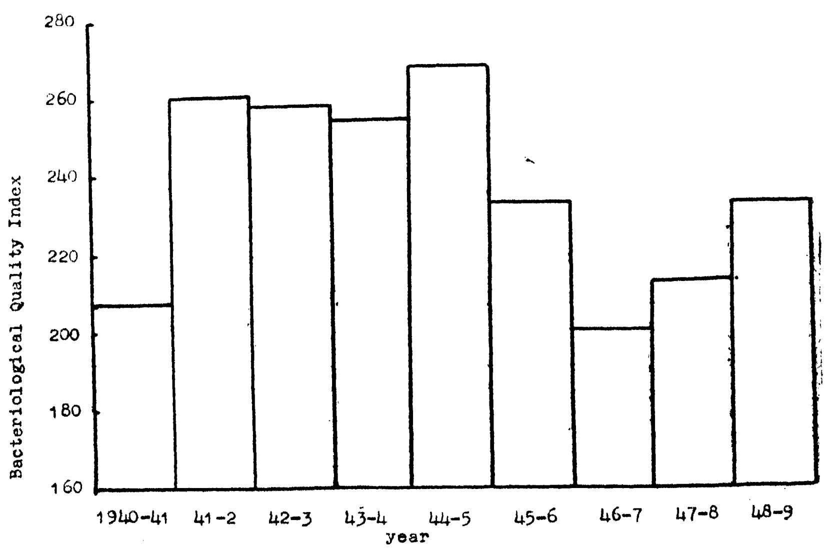


Plate 81.

AVERAGE BACTERIOLOGICAL QUALITY INDEX.

RESULTS.

Bacteriological.

The average Bacteriological Quality Index from 1940-41 to 1948-49 is shown graphically (Plate 81). It will be seen that satisfactory results were obtained early in the history of the Service and maintained until the year 1944-45. For the next two years a marked drop was evident, coinciding with the deterioration of factory equipment which had been practically unobtainable during the war years, the acute shortage of suitable detergents and chemical sterilizers, and, in many cases, the labour shortages. The gradual improvement from 1946-47 onwards has probably been partly the result of an improved supply of necessary equipment, detergents, and chemical sterilizers. However, the intensification of efforts by field and laboratory staffs made possible by the availability of more officers, combined with the efforts of factory managers, has undoubtedly resulted in part of the improvement.

Quarterly averages are probably more indicative of the true standard of factory hygiene, as the results show a strong seasonal trend. Table 1 shows the quarterly averages for the last two years. It will be seen that lower averages coincide with the summer months, and, of course, the flush period for butter production, which is the critical testing time. The need for special care in the treatment of cream and butter manufacture in the warmer months is shown by this trend.

TABLE 1.

Quarter.	1947-48.	1948-49.
July-September	247	279
October-December	209	200
January-March	163	187
April-June	227	263
Yearly average	210	229

Chemical.

Moisture and salt.—The improvement in the average moisture content has been steady since the inception of the Service (Plate 82). The salt percentage, however, has varied to some extent (Plate 83) but extreme variation in the salt percentage which was common originally is now infrequent.

Table 2 compares an estimate of the average composition of Queensland butter prior to the introduction of the Service with an estimate for 1948-49 (which includes an allowance for the group of seven factories with their own service).

It will be seen that about 1 per cent. more butter is being obtained from the same quantity of butterfat, representing about 1,000,000 lb. on Queensland's annual output. The improvement in moisture and salt figures between 1947-48 and 1948-49 corresponds with a gain of about 100,000 pounds of butter.

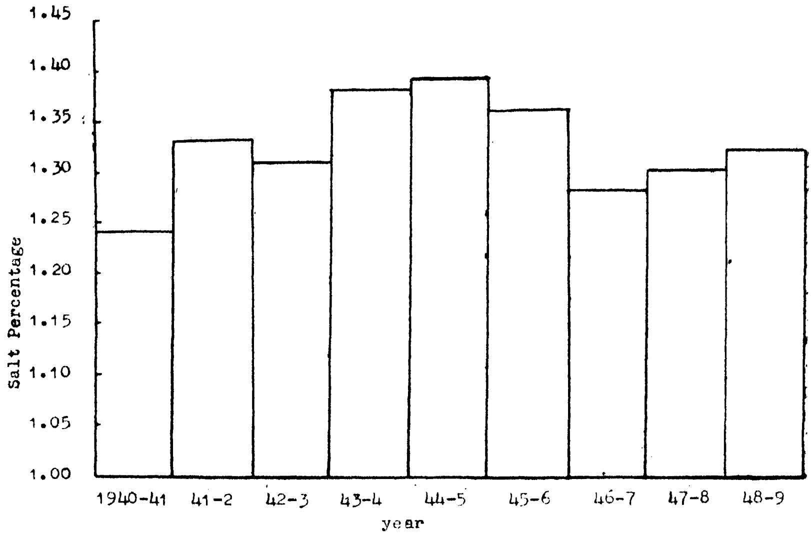


Plate 82.
AVERAGE SALT RESULTS.

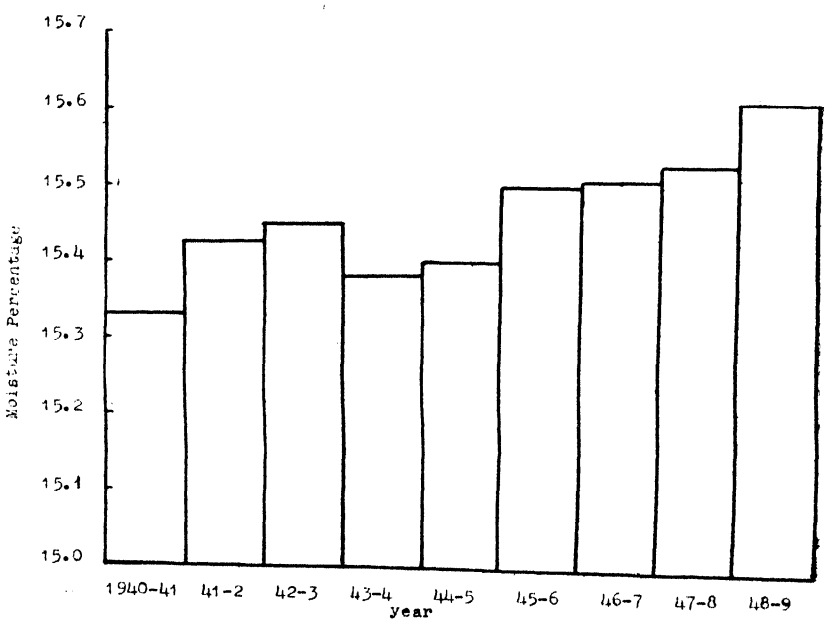


Plate 83.
AVERAGE MOISTURE RESULTS.

TABLE 2.

—	Prior to Service.	1948-49.
	Per cent.	Per cent.
Water	14.9	15.62
Salt	1·0	1·33
Curd	0·8	0·83
Fat	83·3	82·22

Intensification of the competitive aspect in moisture and salt control by the introduction of a points score appears to have had a good effect, particularly in relation to the moisture percentages. Table 3, showing the quarterly average moisture and salt percentages and average point score, illustrates this improvement.

TABLE 3.

Quarter.	No. of Samples.	Average per cent. Moisture.	Average per cent. Salt.	Average Points Score.
January-March, 1948	471	15·47	1·21	70·0
April-June, 1948	391	15·53	1·19	76·5
July-September, 1948	484	15·51	1·29	77·4
October-December, 1948	456	15·56	1·32	79·5
January-March, 1949	741	15·62	1·29	83·0
April-June, 1949	620	15·66	1·27	84·6

The good position in butter composition is well illustrated by the fact that in 1948-49, 26 of the 53 butter factories averaged 15.7 per cent. or more for moisture and 35 averaged 1.3 per cent. or more for salt. It only requires a little better effort by a few factories low on the list to ensure the highest possible efficiency in this aspect of butter manufacture.

pH.—The results since the introduction of pH determinations to the Service are summarised in Table 4.

TABLE 4.

Quarter.	No. of Samples.	Per cent. Distribution of Samples.			Average pH.
		5·6–6·7 pH Range.	6·8-7·2 pH Range.	7·3-8·2 pH Range.	
July-September, 1948 ..	143	7	32	61	7·46
October-December, 1948 ..	229	12	31	57	7·32
January-March, 1949 ..	404	9	42	49	7·26
April-June, 1949 ..	341	5	24	71	7·42

The small percentage of acid butters shown above (range 5.6-6.7) is desirable for the best keeping quality and it is hoped that further efforts will result in lowering the percentage of highly alkaline butters. If a residual cream acidity of 0.08 per cent. is aimed for by the factory operative, this objective should soon be achieved.

CONCLUSIONS AND RECOMMENDATIONS.

The results obtained and the methods used under the Butter Improvement Service for the past nine years are presented and discussed. It is shown, that, with the exception of a decline in bacteriological quality at the end of the war period, there has been a fairly steady improvement in bacteriological and chemical quality of butter.

The operation of the Service throughout the years has been made easier by the increasing co-operation and interest of many factory managers. To further increase this interest, competitions using Butter Improvement Service standards as a basis for judging have been a feature of the Factory Managers' Conferences. This co-operation has also been appreciated because of the opportunity it has afforded the Laboratory to commence a study of some factors affecting the keeping quality of butter.

The bacteriological results of many factories illustrate clearly that an excellent standard of hygiene can be maintained in practice by the use of adequate cleaning and sterilizing methods. Criticism is often levelled at the bacteriological results on the grounds that some factories with rather poor results still produce butter of good grading quality. It must be stressed that the grading quality of butter is seldom directly related to the bacteria counts. A factory with rather high counts can grade consistently well if the types of bacteria are relatively harmless and if the butter is thoroughly worked. However, where poor hygiene exists, bacteriological defects such as "rabbito" can and do occur, often resulting in extensive losses. Prevention of such losses, and more particularly maintenance of that high standard of hygiene very necessary in handling any food material, are the reasons for a bacteriological control system.

The chemical control in butter manufacture has reached a stage where only a little more care and attention to detail is necessary to achieve a high overall standard of efficiency. In moisture control, further attention by some buttermakers to the estimation of churn loads seems to be needed, while regular salt testing at the factory should lead to more evenly salted butter. With neutralisation, frequent checking of the residual cream acidity and comparison with the pH results supplied should facilitate adjustment of the pH to the range recommended. It is worth remembering that, within limits, the percentage of salt in the butter bears little relation to the occurrence of grading comments about harsh salting. A butter of low salt content may well be penalised by a butter grader if the salt is poorly distributed and only partially dissolved through underworking, while a thoroughly worked butter of relatively high salt content will probably be free from any harshness.

The uplift of butter quality is an urgent problem confronting the industry. Compliance with the standards set by the Butter Improvement Service, and careful cream grading, should ensure that any loss of quality from controllable causes in the factory is minimised. The major part of any further uplift in butter quality must, however, come from improvement of cream quality.

Wool and its Physical Properties.

G. R. MOULE, Director of Sheep Husbandry.

THROUGHOUT the history of our civilisation wool has been well known for the part it has played in clothing the people of the world. According to modern concepts, clothing should keep the body at its normal temperature and should protect it from sudden changes in the temperature of the atmosphere. It should not cling to the body or feel wet, nor should it irritate the skin. It should be light and comfortable, and protect the body from the sun's radiation. It should also be satisfying in appearance and should be easily laundered.

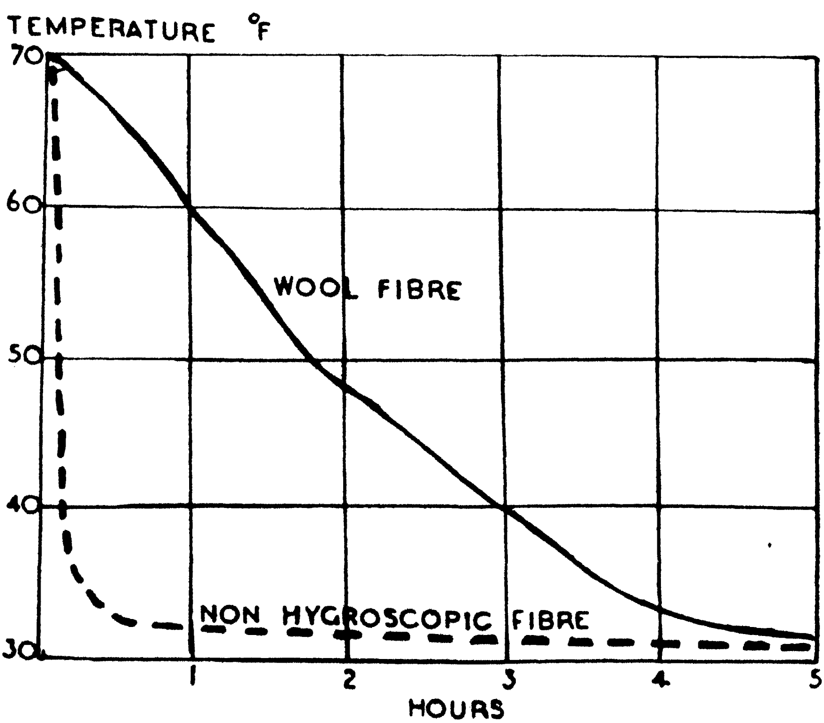


Plate 84.

SHOWING HOW WOOL, AS COMPARED WITH FIBRES OF OTHER FABRICS, ALLOWS TEMPERATURES TO FALL SLOWLY.

Wool satisfies many of these criteria because of its physical properties. Woollen fabrics are particularly thermostatic—that is, they protect against sudden changes in temperature. Plate 84 shows how wool acts as a buffer and allows the temperature to fall slowly, whereas the non-hygroscopic fibre allows it to fall very suddenly. Woollen fabrics are absorbent and porous, elastic and resilient, and in addition are strong and durable but light and soft. It is well known that wool has an exceptionally high capacity for taking up dye, and accordingly woollen fabrics are satisfying in appearance. Because of their softness they do not crease. In addition, wool has the distinct advantage of being non-inflammable.

All of these qualities can be linked closely with the physical properties of wool and accordingly an appreciation of these is essential to an understanding of wool utilisation.

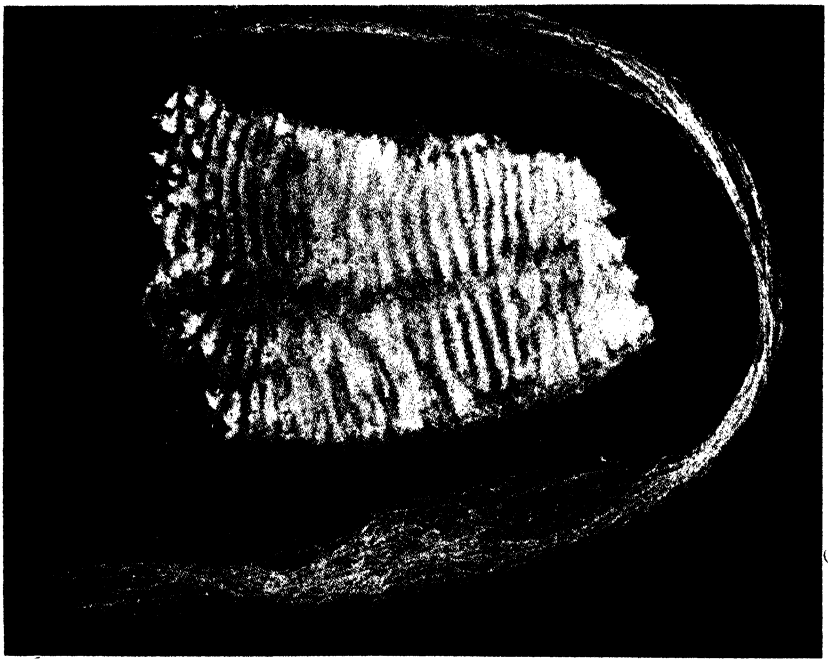


Plate 85.
MICROPHOTOGRAPH OF SHORT AND LONG WOOL.
(From "World Book of Wool.")

Fibre Length.

On first glance it appears to be easy to assess the length of a staple of wool. However, if an attempt is made to measure staple length it soon becomes evident that it is sometimes difficult to decide where the majority of fibres end. Should individual fibres be removed from the staple and measured while sufficient tension to straighten the crimp, but not stretch the fibre, is applied, surprising results will be obtained. In a staple of Merino wool which is about 3½ inches in length, some fibres as long as six inches will be found, while others will be as short as three inches.

The manufacturer is well aware of this variation in the length of the individual fibres in a staple and he also knows that long fibres spin strong yarn. For this reason the wool classer always differentiates the short from the long stapled wools and the buyer looks for the longer wools when seeking lines which can be made into worsted material. A worsted yarn is spun rather tightly so that long threads are closely wound about one another, and as the yarn has a great number of twists per inch the long fibres grip firmly, giving the thread great strength and the fabric a smooth finish.

The shorter wools are used for the manufacture of materials known as woollens, in which the longer fibres lie parallel to one another and the shorter fibres are allowed to criss-cross them. Woollen yarns are not spun as tightly as worsted yarns (Plate 86) and woollen fabrics have a soft fluffy finish. Blankets are a good example.

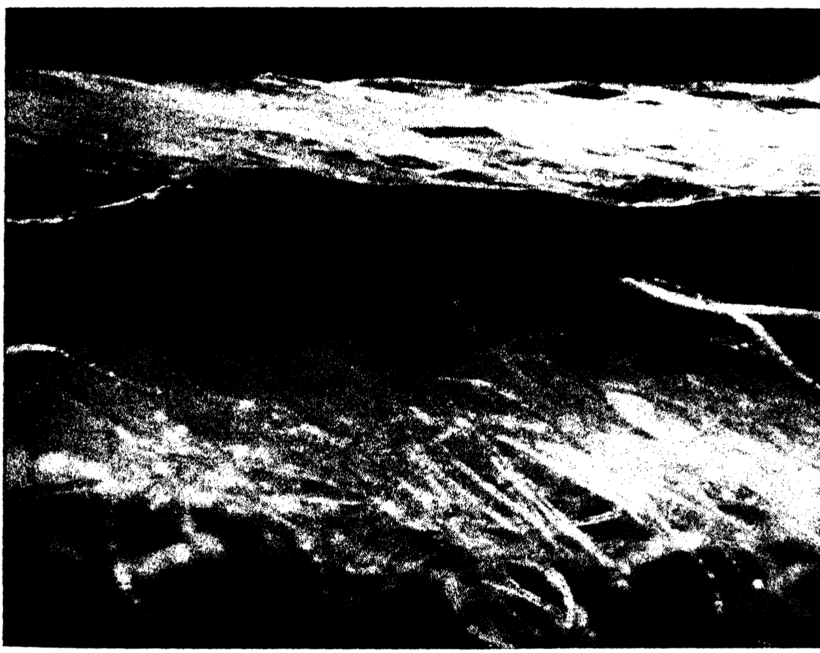


Plate 86.
MICROPHOTOGRAPH OF WORSTED AND WOOLLEN YARN.
(From "World Book of Wool.")

Fibre length has two important influences on wool production. A fleece consists essentially of a large number of minute cylinders of wool keratin, each possessing a certain length and a certain diameter. The longer the fibres the greater the volume of wool keratin in each cylinder and consequently the greater the weight of the fleece. On the other hand, the longer the fibres the more the fleece is likely to open, exposing the tips of the staples to damage by the radiant energy of the sun. Damaged tips break in the manufacturing process, forming short fibres called "noil." While the noil can be worked in with the carded wools, it represents waste to the manufacturer who has bought the long wool for spinning into worsted yarn.

Fibre Diameter.

Merino wool is renowned for fineness of fibre diameter, while it is well known that the wool from the sheep of the British breeds is somewhat coarser. Despite their fineness, wool fibres have great tensile strength and it is possible to spin them into fine yarns which are very strong. A surprising length of yarn can be spun from a pound of combed tops, as the wool is called after the fibres have been laid parallel. When the yarn is spun it is wound into hanks, each being 560 yards long, and a system of counting the number of hanks of wool which can be spun from a pound of combed tops, made from any line of wool, has been adopted by the trade.

Working with Merino wool produced in South Africa, Duerden established a relationship between the number of crimps per inch, the average diameter of fibres in a staple of wool, and its spinning capacity. The scale he developed is known as the Duerden Scale and it is set out as Table 1.

TABLE 1.

THE DUERDEN SCALE.

Count.	Crimps per Inch.	Average Fibre Diameter in Microns*.
100's	22–24	15·4–16·2
90's	20–21	16·2–17
80's	18–19	17·0–17·9
70's	16–17	17·9–18·9
66's	14–15	18·9–20·0
64's	12–13	20·0–21·3
60's	10–11	21·3–23
58's	8–9	23·0–25·5
56's	6–7	25·5–29

*1 micron = 1/25,400 of an inch.

Duerden worked mainly with wools grown by stud sheep which had fairly uniform conditions and were adequately fed. The relationship between crimp and fineness of Australian wools has been investigated by Lang, who has shown that the Duerden scale is too narrow to fit Australian conditions. The relationship between crimp and fibre diameter of wools grown by flock sheep in Australia is not as close as that suggested by Duerden. However, because of compensating errors a large line of wool usually spins close to the expected count.

In a recent survey some groups of wool fibres whose diameters had been measured were submitted to a number of people who were asked to arrange them in order according to fineness. The results revealed that skilled wool classers were capable of recognising differences in the diameter of groups of fibres as small as 2.5 microns. Reference to the Duerden scale indicates that even skilled classers may find it difficult to differentiate between wools of consecutive counts by the visual examination of fibre diameter alone.

It should not be imagined that all the fibres in a staple of wool are of the same diameter. There is some variation even in the best wools, while some of the "rougher" types may have wool which has a very wide variation in fibre diameter.

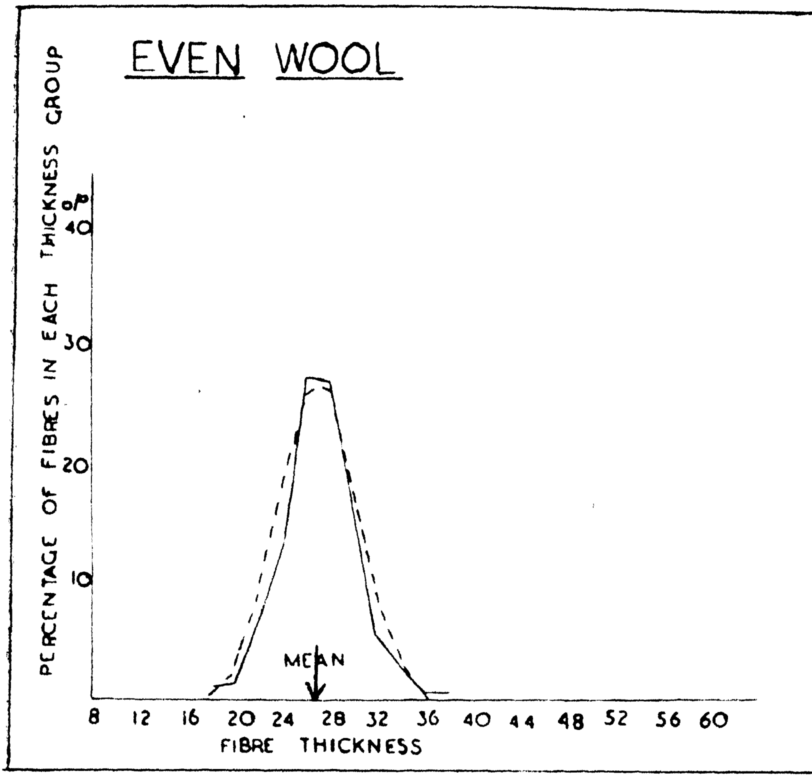


Plate 87.

SHOWING THE RESULTS OF MEASURING THE DIAMETERS OF THE FIBRES IN AN EVEN STAPLE OF WOOL.—The number of fibres in each thickness group is indicated by the continuous black line. The dotted line shows the results which would be obtained from measuring the "theoretically perfect" sample.

By measuring the diameter of a large number of fibres in a staple and counting the number of fibres of each thickness, it is possible to express the variation in fibre diameter by means of the graphs in Plates 87 and 88. These show an extremely even wool (Plate 87) and a very uneven wool (Plate 88). In this latter there is a group of coarse fibres which may mask the appearance of the whole fleece. Variations also occur in the shape of fibres, some being quite oval. This is of particular importance in manufacture, because a few oval fibres amongst normally round ones may cause considerable distortion in the yarn.

Variations in diameter of the fibres in a staple can be of paramount importance to the producer. Remembering that the weight of the fleece is dependent upon the volume of keratin in each cylinder of wool, it will be realised that the greater the fibre diameter the greater the volume of each cylinder. If, however, a group of coarser fibres masks the picture so that a sheep whose wool is predominantly fine appears to be a "strong" wool, its fleece may be considerably lighter than is anticipated. The importance of this to the man who is selecting a top ram for stud use cannot be stressed too strongly.

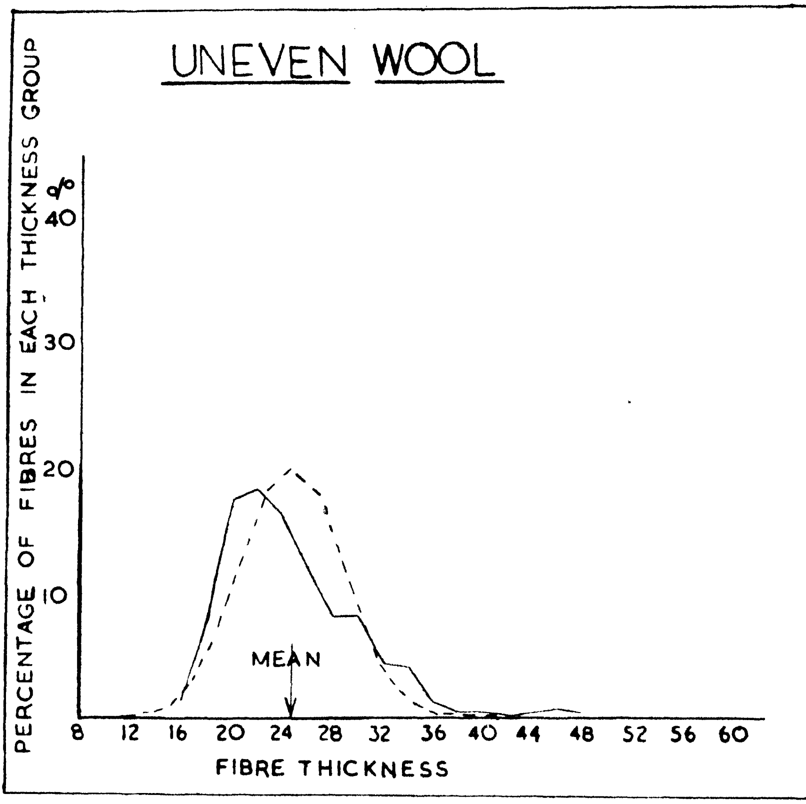


Plate 88.

SHOWING THE VARIATION IN FIBRES IN AN UNEVEN STAPLE OF WOOL AND THE DIFFERENCE IN THE NUMBER OF FIBRES IN EACH THICKNESS GROUP.—The distribution is indicated by the continuous black line, while the dotted line shows the theoretical distribution of the fibres in each thickness group for a staple which has a wide range between its finest and coarsest fibre.

The capacity of woollen clothes to protect the body from sudden changes in atmospheric temperatures and to absorb moisture is largely dependent upon the diameter of the fibres. A large amount of air is entrapped between the fibres, and this insulates the body from sudden changes in atmospheric temperature. The nap on blankets or on Harris tweeds increases the amount of air held between the fibres and this accounts for their warmth. In addition, wool itself is a poor conductor of heat and this gives protection against radiant energy as well as against sudden changes in temperature.

It may come as a surprise to some people to know that the clothes worn by the average city man, and weighing about 8 lb., contain about 1 lb. of water. When there is a dry wind blowing the amount of water is reduced to about ½ lb., while on a hot moist day it increases to over 1¼ lb. The question immediately arises as to where this water is secreted. Each fibre in a woollen fabric becomes ensheathed by a thin film of water. It is interesting that the total surface area of the fibres in 1 lb. of 64's Merino wool is about 800 square feet. As there are about 3½ lb. of wool

in the clothes worn by the average city man, the total surface area of the fibres is very high and this is responsible for the absorptive capacity of woollen fabrics.

Tensile Strength and Elasticity.

The experienced wool classer always selects a staple from a fleece and tests it for soundness before he decides the line. He does this because the uses to which the wool can be put are partly dependent upon its tensile strength and elasticity. Wools lacking tensile strength break easily during manufacture and form a large amount of noil. In addition, wools lacking tensile strength have to be blended with sound fibres to ensure a fabric which has normal strength.

If an independent wool fibre is stretched it will expand a certain amount and then break. It is interesting to know that the same force would be required to break a thread of steel of the same diameter. However, the other fibres used for clothing are stronger than wool—silk for instance has 2½-3 times the strength of wool, and nylon is still stronger. Cotton is twice as strong as wool.

These fibres are not as elastic as wool—that is, the wool fibre will stretch to a greater length without breaking. Besides giving the extra length obtained by extending the crimp, the protein molecules in the wool fibre are arranged so as to permit extreme extension. It is known that the spindle cells can stretch up to three times their normal length. Some wools lack elasticity and tensile strength. This is particularly noticeable in the case of fleeces grown by animals which have suffered from nutritional deficiencies or ill health. Lack of tensile strength can be brought about by a decrease in the volume rate of production of wool keratin, leading to a general reduction in the diameters of wool fibres. An example of this is seen in sheep which have suffered bad fly strike.

New Zealand investigators found that there was a fairly definite ratio between the tensile strength of the fibres in the sound and tender parts of the staple. Generally speaking, when there was slight break the sound regions of the staple could stand about three times the load of the tender parts. When the break was bad, the sound parts could stand about eight times the load of the tender parts.

It is well known that sheep suffering from copper deficiency grow wool which is "rotten," as it can be broken at any point along the staple despite the lack of any indication of a decrease in fibre diameter due to a diminution in the volume rate of production of wool keratin. It has been suggested that when sheep are subjected to copper deficiency there is an interference with the arrangement of the protein molecules in the wool fibres.

Handle.

Handle is important to the manufacturer because it connotes whether the wool has "body"—that is, it indicates the fullness as well as the softness of the final product.

It is a composite character which is not easy to describe. It refers to the ability of a line of wool "to fill the hand" and at the same time retain its traditional softness.

The ability of any line of wool to fill the hand will be dependent upon the respective lengths of the individual fibres, the average diameter

of the fibres, and the variation in fibre diameter and the resilience of the fibres, which may be influenced by the arrangement of the protein chains. In addition, the amount of yolk and foreign matter may have an influence.

The softness of a staple of wool is partly dependent upon the diameter of the fibres, on the pliability of the fibres and the presence of hairs of kemps in the staple, and on the number of folds in the outer cortical sheath of the fibres themselves.

Wools grown by sheep depastured on copper deficient areas are notorious for their slippery handle and for their lack of body. The trade often describes wools of this type as "gutless."

When compared with wools of similar fibre diameter and staple length, copper deficient wools are somewhat like silk. They lack substance and can be compressed into a small space. This is probably due to lack of elasticity and resilience, which may result from a retardation of the rate at which keratinisation is completed in the wool follicle.

Colour.

There is considerable variation in the colour of greasy wool, depending upon the type of country in which the sheep are running. A good deal of this is due to dust and vegetable matter, which will come out during scouring, but there is some variation in the colour of the scoured wool and this is important to the manufacturer and hence to the buyer.

Several factors influence the colour of scoured wools. Long-woolled sheep of the British breeds have a lustre about their wool, while that of the Downs breeds tends to be duller. It is usually considered that the so-called scales formed by the folded outer cortical sheath reflect a good deal of light. This helps to give wool its well known brightness, as distinct from the lifeless flat chalky white of fibres without surface scales.

Environmental influences have an important bearing on colour. Wools which have been damaged by the sun's radiant energy lack brightness, and canary stain, resulting from sudden changes in feed accompanied by hot humid weather, is well known in the trade. Because it cannot be removed by scouring it depreciates the values of clips very considerably.

The colour of wool, including its brightness, has an important influence on its reaction in the dying vats. The dye gets in through the minute pores between the folds of the cuticle sheath. Thus the size and arrangement of the folds in the cuticle sheath influence the appearance of the dyed fabric.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 1st FEBRUARY, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas
Jersey	W. E. O. Meier. "Kingsford" Stud, Rosevale, via Rosewood.

ANIMAL HEALTH

Tick Fevers of Cattle in Queensland.

C. R. MULHEARN, Divisional Veterinary Officer.

TICK fever and redwater, the popular names applied to a disease of cattle caused by extremely small blood parasites transmitted under natural conditions by the cattle tick (*Boophilus microplus*), only occur within the tick-infested zones.

Introduced into northern Australia with the tick towards the end of the last century, it accompanied that pest in its spread southwards through Queensland.

The initial outbreaks of the disease caused heavy mortality, often exceeding 50 per cent. of the local cattle population. As the tick became established, however, the remaining cattle acquired resistance, and as most young cattle bred in tick-infested country develop a natural resistance, the disease is usually now only responsible for comparatively small losses within the tick-infested area.

Cattle continually exposed to tick infestation carry these small blood parasites in their systems and are resistant or immune, whereas most cattle over one year old, which have been bred in tick free country, will readily contract the disease if exposed to tick infestation. Such animals are referred to as being susceptible.

Economic Importance.

The disease is of serious economic importance to the Queensland cattle industry. As the tick is mainly confined to the coastal watershed, cattle bred in tick-free country cannot be moved to and maintained in tick-infested country without the risk of serious loss. This interferes with the free movement, fattening and marketing of cattle from inland to coastal Queensland and vice versa.

Another form of loss and inconvenience is incurred when stud cattle are introduced from clean districts into the tick area. If these cattle are forwarded direct to the holdings, it is certain that they will suffer an attack of tick fever, often with fatal results, and consequently it becomes necessary to inoculate them prior to introduction to the tick-infested country. After inoculation, such animals are highly resistant to infection.

Frequently, losses occur in cattle in marginal country—that is, country situated between the definitely tick-infested and the definitely tick-free country. Owing to seasonal and other conditions, the animals in these marginal areas may not be exposed to ticks for several months or even years, and consequently become susceptible to tick fever. When they are again exposed to ticks, as they may be in a favourable season, severe loss is likely to occur.

Losses are also continually occurring in cattle within the tick zone. This occurs particularly in areas where dry seasons cause a diminution in the number of ticks or where these parasites have been killed out by too frequent dippings.

Method of Transmission.

As already stated, tick fever is an infectious disease caused by small blood parasites spread by means of the cattle tick, and does not occur where the tick is non-existent.

The tick spends the whole of its parasitic life on the same animal, and if this animal is a "carrier" these blood parasites are taken up by the tick, which transmits through its eggs these same parasites to its progeny, the larval ticks, which pass them into a second animal to which the progeny, in their turn, attach. In this manner, most cattle in tick-infested country are being constantly reinfected, and this keeps them immune or resistant to the disease.

Ticks, as such, are therefore not responsible for outbreaks of tick fever, but the disease results from the blood parasite passing from one generation of ticks to the next. All ticks do not carry these organisms; for example, if a tick developed on a "non-carrier" animal, the next generation of ticks would not carry them. Ticks which carry the organism are often referred to as infective or "pathogenic" ticks, but to outward appearances they are no different from non-infective ticks. It has been stated that different types of ticks transmit different forms of tick fever, but this is a fallacy, as there is only one common cattle tick in Queensland and this one transmits all forms of tick fever.

Outbreaks of tick fever develop only when infective ticks become attached to susceptible cattle.

There is quite a pronounced variation in susceptibility in different ages and types of cattle. Young animals have a strong natural resistance; hence they usually contract the disease in a mild form but develop a strong resistance, which is maintained provided they are exposed to a certain degree of tick infestation. This age resistance gradually decreases, and is largely lost when the animal is 9-12 months old.

As a general rule, old animals in fat condition are more susceptible and contract the disease in a more severe form than young light-conditioned animals.

The incidence of the disease varies from year to year. It is usually most prevalent in a good season, when conditions are suitable for tick propagation, following a series of dry seasons.

Symptoms.

For many years, it was considered that tick fever in Australia was caused by a single blood parasite, but it is now known that several organisms may be responsible for different forms of the disease. The most important of these are the piroplasm and babesiella, both of which produce symptoms of redwater, and the anaplasm, which produces a more chronic type of disease.

The first symptom in the redwater form of the disease is fever, and this may be noted even while the animal is apparently normal in other respects. The temperature gradually rises over a period of days, and it may reach a maximum of 106-108 degrees at the height of the

fever. In milking cows, there is usually a marked reduction in milk yield shortly after the onset of the fever. Scours may be evident in the early stages, though constipation usually follows.

A few days after the onset of fever the appetite is depressed and the animal will isolate itself and stand in the shade. At this stage, the ears droop and the coat is roughened. Jaundice then becomes evident, and may be noted from an examination of the eyes or mouth. It may be difficult to detect in Jersey cattle. Red urine may also be passed, and this must be looked upon as a very serious symptom, for the animal is then in an advanced stage of the disease. In this advanced stage, the eyes are staring, the muscles quiver, and the animal is unsteady on its feet; it finally collapses, becomes unconscious and dies.

In the less severe cases, in which the animal recovers, it may or may not reach the stage of redwater and then gradually improves, finally coming back on to its feed after a period of several days. In such cases, the animal loses condition, the blood becomes weak and there is a definite pallor about the mouth and eyes. The crisis is usually passed in less than a week.

In the anaplasmosis form, the course is less severe but more prolonged, and the animal loses much condition and becomes weak. It may take months to completely recover.

Post-mortem Changes.

The carcase may show small bleedings throughout the tissues, which are often stained a definite yellow colour, particularly noticeable in the fat, due to generalised jaundice.

The body cavity may contain a quantity of blood-stained fluid, whilst the liver is usually enlarged and bronze coloured. The gall bladder may be full of thick bile. The spleen is very enlarged, sometimes up to twice its normal size, and instead of being firm it feels soft and doughy and the interior is of a semi-fluid consistency.

The kidneys are darker in colour than normal and enlarged. The bladder usually contains a quantity of urine, which may vary from a dirty red to a port wine colour. This, however, is not a constant feature, for on rare occasions an animal may die of tick fever and the urine remain a dark amber colour.

Animals which die of the anaplasmosis form of tick fever show evidence of loss of condition, generalised jaundice and extreme pallor due to poverty of the blood, but the urine remains normal in colour or is a dark amber.

Deaths due to anaplasmosis are seldom encountered, and the majority of tick fever deaths are due to the redwater forms, and particularly the form known as babesiellosis.

Difficult Diagnosis.

The foregoing symptoms and post-mortem findings are those encountered in typical cases, which should be diagnosed without much difficulty. However, typical cases are sometimes encountered, and some difficulty may be experienced in making a field diagnosis. Again, there are other diseases which present both ante- and post-mortem findings very similar to those of tick fever, and in such cases it becomes necessary to enlist the aid of the laboratory to assist in correct diagnosis.

Specimens to be submitted for this purpose are blood smears from the live animal (Plate 89), and, from the dead animal, liver, spleen and particularly kidney smears.

Plate 89.

TAKING A BLOOD SMEAR FOR DIAGNOSIS OF TICK FEVER.—A vein in the ear is pricked, a drop of blood is spread thinly on a glass slide, and the smear dried rapidly.

A smear is made by spreading a small drop of blood very thinly over the glass slide and drying it rapidly.

Specimens such as portions of the liver, spleen and kidney and a small quantity of urine may also assist in arriving at a diagnosis.

Diseases which may be confused with tick fever are lantana poisoning, leptospirosis and enzootic haematuria.

In lantana poisoning, there is generalised jaundice, but no red urine. Other typical features of this condition are peeling of the nose and black scours.

Leptospirosis is very similar in many respects to tick fever and is frequently seen in its worst form in young calves, up to six months old, but also affects aged cattle. Red urine is a prominent symptom of this disease.

Enzootic haematuria chiefly affects aged cows, which pass blood and blood clots in the urine. It is a more chronic disease than tick fever.

Treatment.

Fortunately, the redwater forms of tick fever may be treated successfully with certain specially prepared specifics, such as Acaprin, Pirevan, Piroparv, Babeson, etc., which can be obtained from most chemists. These specifics are usually in the forms of a solution put up

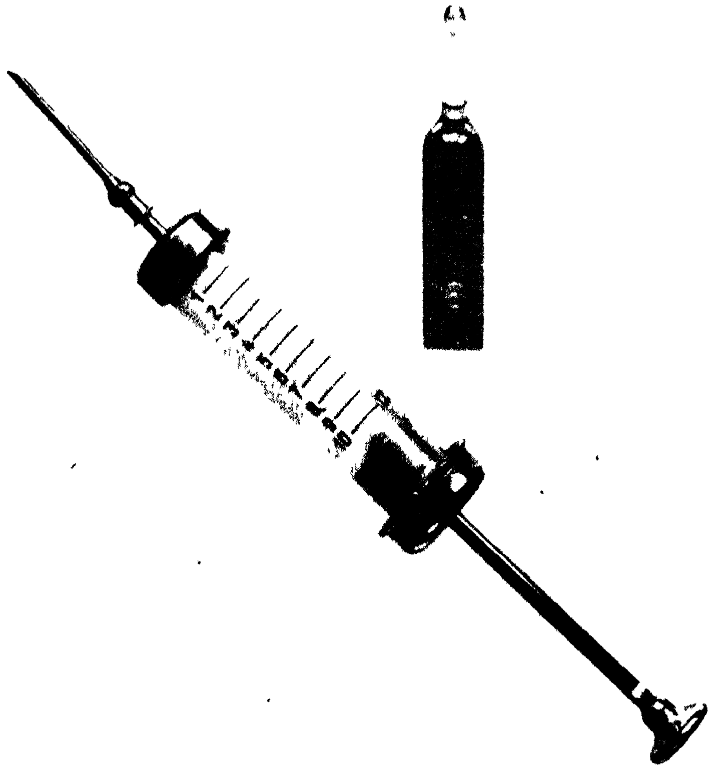


Plate 90.
HYPODFRMIC SYRINGE AND AMPOULE OF SPLCIFIC FOR TRFATMENT OF TICK FEVER.

either in ampoules of 6-10 c.c. (Plate 90) or in 50 c.c. rubber-stoppered bottles. The preparation must be injected under the skin by means of a hypodermic syringe, and the dose rate is from 6-10 c.c. If the animal does not recover within 24 hours after the injection of a single dose, treatment should be repeated.

These drugs are very effective, particularly if given during the early stages, and evidence of recovery will usually be noted in less than 24 hours, with complete recovery in a few days.

In advanced cases, more difficulty may be experienced in effecting a recovery, and it may be necessary to give two or even three doses at 12-hourly intervals.

In some instances, owners should be able to anticipate outbreaks of tick fever—for example, when susceptible cattle are inoculated or moved onto tick-infested country—and they should be prepared to treat these cases before they become too advanced. A temperature of 105-106 deg. should be looked upon seriously, and the animal treated, particularly if it is showing any other signs of illness.

In the tick-infested area, any cattle which show signs of sickness and fever, without an obvious reason, should be suspected of developing tick fever and treated as a precautionary measure. No ill effect will result from the treatment if the animal is not suffering from tick fever. The drug, however, has no value as a preventive and will not be effective unless given when the animal is actually suffering from the disease.

If it is necessary to move animals to yards for treatment, they should be taken quietly, as over-driving aggravates the fever and may cause collapse and death.

If an outbreak occurs in travelling cattle, they should be spelled at some convenient place and the affected animals quietly drafted off for treatment.

Prevention and Immunisation.

It frequently happens that it is necessary to transfer susceptible cattle from tick-free to tick-infested areas, and unless certain precautions are taken in such cases losses are certain to occur following exposure of the animals to ticks.

This precaution may take the form of preventive inoculation (Plate 91) and/or treatment with a tick repellant dipping fluid, such as DDT solution. The DDT treatment would be satisfactory if the animals were being held for temporary periods in tick-infested country, and they would have to be treated at 7-day intervals. If the animals were to be held permanently on tick-infested pastures, inoculation would be necessary.

Inoculation consists of an injection of blood freshly drawn from a specially prepared animal (Plate 92.) Several systems of inoculation may be used according to circumstances.

The most satisfactory system consists of a double inoculation, using firstly piroplasm blood, which gives a relatively mild reaction, and about a month later babesiella blood, which fortifies the resistance produced from the first inoculation.

These inoculations are best carried out prior to exposure to tick infestation, so that the animals will have a strong resistance to tick-borne redwaters when subsequently exposed to ticks. If these inoculations are carried out in tick-infested country, it would be desirable to regularly dip the animals in DDT or similar preparations to minimise the risk of tick infestation until the reaction has passed.

It is not always practicable to undertake this double inoculation, so in many cases blood containing both these organisms is used. The risk of severe reactions is greater with this method, and unless precautionary measures are taken and the cattle are kept under close observation losses may occur.

Inoculation with a mild form of anaplasm may be combined with either of the above methods.

After inoculated cattle are exposed to ticks, they should be carefully watched for about one month. If no outbreak occurs within this time, it can be assumed that the inoculation has been successful and the animals will remain resistant.

Cows which are heavy in calf should not be inoculated, for a severe reaction may bring on abortion.

Plate 91.

INOCULATING A BEAST.—The method of inoculation is identical for both the preventive and the curative treatments.

Cattle Which Should be Inoculated.

Stud cattle which have been bred and maintained in tick free country until they are 12 months old or older should be inoculated prior to being transferred to tick-infested country. These inoculations are usually undertaken at the Animal Health Stations, under the supervision of Departmental officers.

Any cattle which have been bred or maintained in a tick-free area for more than 12 months should be inoculated before being transferred to tick-infested country. Blood for this purpose may be obtained from the Animal Health Stations, but it should be used within 24 hours of despatch from the laboratory.

If a large number of animals are to be inoculated, it may be more convenient to take a specially prepared bleeder to the place where the inoculation is to be done, and bleed it immediately before the inoculation.

Inoculations are also regularly carried out in the "marginal" country, and in any other area where the degree of tick infestation is light and subject to fluctuation.

Plate 92.
DRAWING BLOOD FOR INOCULATION FROM A "BLEEDER."—The blood is taken from the jugular vein into a sterilized bottle.

Owners can frequently anticipate any marked increase in the degree of tick infestation and inoculate as a precautionary measure; in other cases, inoculations must be regularly practised each year to avoid losses.

Both blood and bleeders for this work can be obtained from the Animal Health Stations at Yeerongpilly (near Brisbane) and Oonoonba (near Townsville).

Noogoora Burr Poisoning of Cattle.

G. C. KENNY (Inspector of Stock, Gympie), S. L. EVERIST (Botanist), and A. K. SUTHERLAND (Senior Veterinary Pathologist).

NOOGOORA burr (*Xanthium pungens*) is one of the worst weed pests in Queensland. The Department's records show that Noogoora burr seedlings have frequently caused very heavy losses among cattle. In October, 1929, 11 of a herd of 55 dairy cattle died within a few days at Bundaberg and 42 head were lost on a farm at Goomeri. Deaths from Noogoora burr poisoning are recorded also as occurring at Proserpine in 1936, Mundubbera and Gympie in 1941, and Maleny in 1946. In September, 1949, 112 cattle (valued at £1,300) were lost in two days in the Gympie district from Noogoora burr poisoning. In the same month, 10 cows in two herds at Eumundi died from the same cause.

The purpose of this article is to record observations made on the recent outbreaks, to describe means of recognising the condition, and to suggest steps which should be taken to prevent loss from it.

Noogoora burr poisoning was studied experimentally at the Veterinary Research Station, Glenfield, N.S.W., in 1930.* These experiments showed that:

(1) Noogoora burr is poisonous to pigs, sheep and cattle, but only when in the very early stages of its growth, i.e. when the seed-leaves or cotyledons are still present on the plant.

(2) The lethal doses of the plant appear to be:

Pigs—2% of the body weight, or about 2 lb. for a 100 lb. pig.

Calves—1.8% of the body weight, or about 4 lb. for a 224 lb. calf.

Sheep—A considerably higher percentage of body weight.

(3) A lethal dose of the plant usually causes death in from 20-48 hours.

(4) Haemorrhagic inflammation is produced in the stomach and intestines.

(5) The poisonous principle appears to be confined to the cotyledons (seed-leaves).

DESCRIPTION OF PLANT.

Noogoora burr is an annual with coarse upright stems and spreading, broad, toothed alternate leaves on long stalks. The stems and leaves are rough to the touch. Although the plant often grows six feet high, it frequently produces large numbers of seeds when very much smaller.

Plate 93.

NOOGOORA BURR SEEDLING 24 HOURS AFTER EMERGENCE.—Note leaf bud between the spreading cotyledons.

* H. R. Seddon and R. O. C. King (1937)—N.S.W. Dept. of Agriculture Veterinary Research Report No. 7, pages 101-108.

The burrs are numerous, oval in shape, about one inch long, brown when ripe and covered with hooked spines. There are also two straight spines, like horns, at one end. The ripe burrs stick tightly to wool, hair and clothing and they float on water and so are distributed over a wide area. The plant grows most abundantly on river and creek flats which are subject to flooding.

Each burr contains two seeds. One of these usually germinates in the first favourable season after it is shed, the other in a subsequent season. Rarely do both seeds germinate at the same time.

Germination takes place in warm weather following soaking rain, usually between the beginning of September and the end of March. Seedlings appear in from 4 to 9 days after suitable rain. At first they consist of two narrow, thick, smooth, tender, dull-green seed-leaves (called cotyledons) spreading out from the top of a soft sappy stalk (Plate 93). The cotyledons are about one inch long, but grow rapidly to about two inches. They are $\frac{1}{4}$-$\frac{1}{2}$ inch wide, blunt at the end, broadest below the middle and taper to a thick, flattened stalk at the base.

Plate 94.

NOOGOORA BURR SEEDLING THREE DAYS AFTER EMERGENCE.—Note the two true leaves with toothed margins.

Shortly after the cotyledons appear, the first true leaves emerge from between them. The true leaves are thinner in texture and somewhat rough because they are covered with short, bristly hairs. They are broader than the cotyledons and their edges are toothed (Plate 94). As the plant grows the leaves become larger and more of them are produced. The cotyledons, too, increase in size for a few days, then turn yellow and wither, usually when the plant is about two weeks old and carrying four to six expanded true leaves.

OBSERVATIONS ON RECENT OUTBREAKS.

Outbreaks of Noogoora burr poisoning occurred, as has been stated, in the Eumundi and Gympie districts during 1949. At Gympie, where 112 cattle died, 19 herds were affected. Deaths were first recorded on 15th September, and the following morning a warning to all farmers was issued from the local radio station. Most farmers quickly moved their herds from burr-infested areas, so that losses occurred on 15th and 16th September only. The few herds that were not quickly shifted sustained losses up to a week later.

One farmer, after losing four cows on 15th September, removed his herd from the dangerous paddocks. He had no further losses for two days. Then the herd again gained access to burr seedlings and three more cows died in the next 24 hours. The cattle were again removed from the infested paddocks and there were no more deaths.

The outbreak of Eumundi caused the death of 10 cows in two herds, the deaths occurring on 12th, 13th and 14th September. In the following month cases were reported in a herd at Wandoan and in one near Brisbane.

Symptoms.

In some herds which appeared healthy at milking time, cattle were found dead when mustering for the next milking. In others, cows which appeared healthy when milked developed symptoms within a couple of hours, then collapsed and soon died.

In the early stages there were signs of excitement, nervousness and trembling, which rapidly developed into a nervous twitching or tetany. Some affected animals would charge when approached. They were very restless and the movements were jerky and the gait stilted. Abdominal pain was shown by occasional kicking at the abdomen. Some animals salivated freely.

Animals soon went down, apparently in great pain, and usually lay flat on their sides. There were muscular spasms involving the whole of the body and limbs. The skin was extremely sensitive and if touched on any part the animal would flinch violently. There was a good deal of groaning and repeated kicking. At times the beast half rolled on its back as it kicked. This rolling may account for the lack of signs of struggling around some of the carcases. In these cases the beast probably kicked at the air instead of the earth so that the undisturbed state of the ground was not necessarily indicative of a painless death. Again, even in instances where the ground had not been torn by the hoofs, marks had usually been made by the movements of the head. In other cases there was evidence that the ground had been kicked a good deal during struggling before death.

Death usually occurred about two hours after going down. There was no scouring, although post-mortem examinations revealed severe inflammation of the intestine.

Course of the Disease.

Cattle poisoned by Noogoora burr usually die within 12 hours. In one herd, however, deaths continued to occur 48 hours after the cattle had been removed from the burr. Four cows had died in this herd before they were shifted, but no animal was noticeably sick when they were taken from the infested pasture. In another herd a few cows recovered without treatment, although they were sick when the herd was removed from the burr-infested pasture.

Post-mortem Findings.

The carcases bloated rapidly after death and rigor mortis occurred quickly. At times carcases bloated to such an extent that the skin burst and the eyes were forced from their sockets.

In the abdominal cavity there were often many small and large haemorrhages on the outer surfaces of the stomach and intestines. The lining of the abomasum showed in some cases intense inflammation, in others moderate diffuse discolouration (congestion) with a few haemorrhages, and in others no departure from normal.

In almost all cases the small and large intestines were acutely inflamed, showing intense reddening and many haemorrhages of the mucous lining.

Lesions noted in the liver in certain cases were swelling of the whole organ, small scattered haemorrhages or brown (necrotic) spots. Haemorrhages were often present on the lining of the gall bladder and sometimes this organ was surrounded by a gelatinous exudate.

In most affected animals the heart had many small and large haemorrhages on both the internal and external surfaces.

In all cases examined, the bladder was distended with urine, suggesting that burr poisoning may interfere with ability to urinate.

Diagnosis.

Although there are certain rather striking features about the symptoms and post-mortem findings in Noogoora burr poisoning of cattle, it might be confused with poisoning caused by other plants or by arsenic. When cases of acute abdominal pain and death after a short illness occur a few days after rain in the warm months of the year, Noogoora burr poisoning should be suspected.

The important point in diagnosis is, of course, evidence that cattle have grazed on Noogoora burr seedlings. Although it is sometimes possible for a botanist to identify the seedlings in the paunch contents, the plants are soft and are therefore easily disintegrated by chewing and digestion.

Nature of the Toxin.

The toxin (poison) present in the cotyledons of Noogoora burr seedlings has not been definitely identified but it is evidently a substance (possibly a glycoside) having a rapid and intensely destructive action on the intestines, liver and heart. Although some samples of

seedlings contain prussic acid, this is not always so, and in any case the symptoms and post-mortem findings are *not* those of prussic acid poisoning.

TREATMENT AND PREVENTION.

The first and most important step in treating sick animals and in preventing further cases is to remove the herd from paddocks containing burr seedlings. After two to three weeks cattle can be returned to such paddocks if the seedlings have grown to the stage where the cotyledons have withered and dropped off the plants. It should be noted, however, that repeated storms in warm weather may bring up fresh crops of young seedlings.

As the poisonous principle in the cotyledons is not known, no specific antidote can be recommended. In fact, the rapid course of the disease would seriously limit the possibility of successful treatment.

NOOGOORA BURR POISONING OF PIGS.

Although the experiments done at the Veterinary Research Station at Glenfield showed that pigs are even more susceptible to Noogoora burr poisoning than cattle, natural cases have been rare among pigs in Queensland. The death of 15 pigs aged 4 to 12 weeks on a farm in the Biloela district is therefore worthy of record. The outbreak was described by Mr. C. V. Lilley, Inspector of Stock, on 17th September, 1949, as follows:—

"The pigs grazed on a cultivated field completely covered with a mat of Noogoora burr up to three inches high and were seen eating the burr seedlings. Pigs first developed a stagger and eventually lapsed into a coma in which they were partly conscious. Death occurred within 12 hours after the first symptoms were noticed. Some animals vomited and others had severe diarrhoea. Post-mortem findings were generalised jaundice, swollen liver, pale soft kidneys and thick dark urine. Deaths occurred up to 15 hours after the pigs were denied access to the burr seedlings."

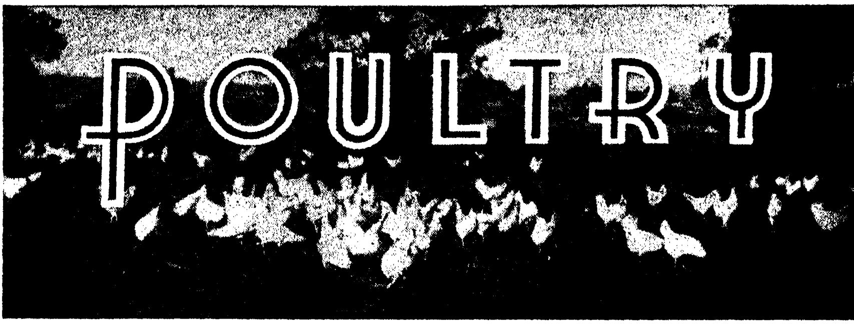
ERADICATION OF NOOGOORA BURR.

The plants can be destroyed by spraying with hormone weedkillers. One crop of burrs can produce at least two crops of seedlings, so it is necessary to spray each crop as it appears. If this is done, the weed can be brought under control quickly. Noogoora burr is susceptible to hormones at all stages of its growth but treatment is cheaper and more effective if it is done when the plants are young. Hormone weedkillers are not poisonous to animals but precautions should be taken to avoid damage to crop plants such as lucerne. Grasses are not killed by the spray.

For killing Noogoora burr the Department of Public Lands offers hormone weedkillers at cost price, freight free to the nearest railway station. Applications should be sent to the Secretary, Land Administration Board, Brisbane, with the following particulars:—

(*a*) Name of property.
(*b*) Rail centre for despatch of supplies.
(*c*) Quantity required.
(*d*) Area and density of Noogoora burr and/or Bathurst burr to be treated.

A free pamphlet giving full information on the eradication of Noogoora burr is available also by request to the Department of Public Lands.



Breeds of Fowls.

P. RUMBALL, Officer in Charge, Poultry Branch.

(*Continued from page 367 of December issue.*)

THE AUSTRALORP (Plate 95).

Queensland Standard as adopted by the Australorp Society, the National Utility Poultry Breeders' Association (Queensland Branch), and the United Poultry Club of Queensland.

Head.—Medium in size; skull fine with no fullness over the eyes; beak of medium length, strong and slightly curved; colour black; 5 points.

Eyes.—Full, prominent and expressive, dark-brown iris, the darker the better: 5 points.

Comb, Wattles, and Lobes.—Medium size, smooth and fine in texture; bright red in colour: comb erect, evenly serrated, and following the curve of the head; wattles neatly rounded; lobes well developed: 5 points.

Face.—Bright red, fine, not sunken, and as free from feathering and wrinkles as possible: 5 points.

Neck.—Medium length; slightly curved, and profusely feathered.

Body, Skin, and Abdomen.—Body deep, broad-backed, and of good length, breast of medium depth, broad and nicely rounded, keel straight, and of moderate length, the whole giving a well-balanced appearance; wings well formed and carried close to body; skin, white texture of finest quality; the abdomen to be elastic and full, but avoiding indications of excessive fat or abdominal weakness: 35 points.

Tail.—Medium length, angle about 35 degrees in the male and 20 degrees in the female: 5 points.

Legs.—Medium length, strong, and wide apart; shanks fine in bone and scale, free from feather or fluff; toes straight and well spread; legs and upper portion of feet slate to black; sole of feet white: 5 points.

Plumage.—Soft, close, avoiding fluff and looseness; colour black, with green sheen: 7 points.

Condition.—As indicated by general health, cleanliness of feathers and legs: 10 points.

Carriage.—Erect and graceful—that of an active bird: 10 points.

Weight.—Cockerel, 7 lb. to 8 lb.; cock, 8 lb. to 9 lb.; pullet, 5 lb. to 6 lb.; hen, 6 lb. to 7 lb.: 5 points.

Total: 100 points.

Disqualifications.—Side sprigs, any deformity.

Serious Defects.—White in lobes.

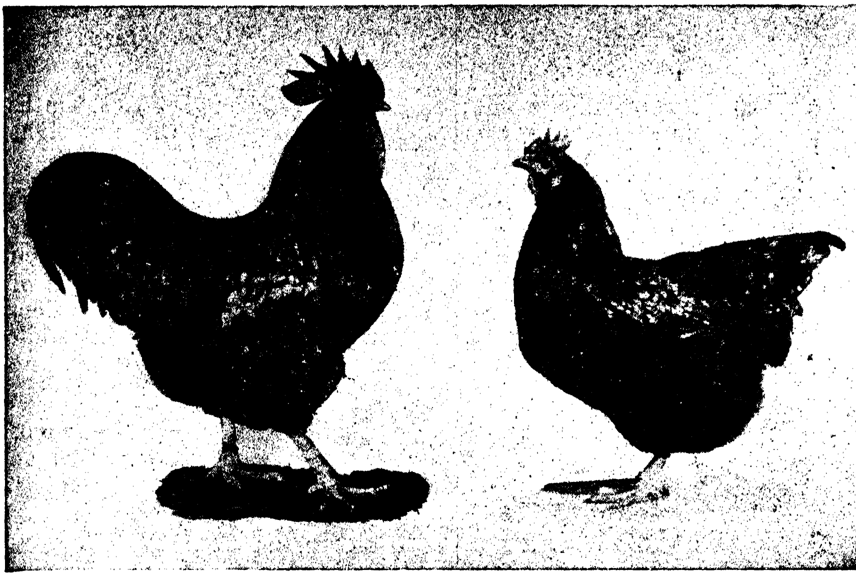


Plate 95.
AUSTRALORPS.

The Australorp has been evolved by a process of selection by Australian breeders from the breed originally known as the Orpington. The Orpington was evolved by Cook, of Kent, in England. Cook states that this breed was made up as follows:—Minorca male mated to a Black Rock female. The female from that mating was mated with Langshan males. The Minorcas used were birds carrying red lobes, and the Langshans were clean-legged.

The Orpington as made by Cook was very little different from the Australorp of to-day. It was a breed made for its dual-purpose qualities. Unfortunately, the original Orpington was developed along certain lines by the fancier until it reached a stage when it was of little or no commercial value to the poultry raiser. Those who were interested in the breed from a commercial point of view, however, did not follow the popular trend and, in order to have something distinct from the show-breed, termed their stock "Utility Orpingtons." From observations it was found that the longer-bodied, closer feathered birds were more productive than other types and breeders therefore selected for these characteristics. It is considered that it is only in these two features that there is any outstanding difference between the Australorp and the Orpington as originally made by Cook.

The Australorp is the most popular dual-purpose fowl in Australia, being a particularly good egg-producer, especially during the first year's production, and at the same time carrying table qualities that are appreciated.

Constant selection has given the industry strains of Australorps in which broodiness is most rare, although the breed is classed as a sitting breed. As no standard existed until 1930, there is considerable variation in types as well as in weight. The weights as laid down by the standard

give a bird of sufficient size for table purposes, and breeders should avoid exceeding these weights with the same degree of care as they would employ in guarding against undersized birds.

It is a rapid-maturing breed, pullets laying at the age of five months being not uncommon, while cockerels can be marketed at the liveweight of 6 lb. at from 18 to 20 weeks.

The standard for the breed gives a very good idea of what is required. As the Minorca and Langshan were used originally in the make-up of the Orpington, avoid using birds in the breeding pen showing any whiteness in ear-lobes or feathers on legs. Closeness of feather is desired. Therefore, in breeding, females with obvious cushions should be avoided. A common fault among males is the profuse saddle hackle standing out well from the body. Males of this type tend to produce females with excessive cushion.

In many strains of Australorps there is a tendency for the comb of the bird, instead of following the curve of the head, to run in an upward direction. This should be selected against in breeding stock.

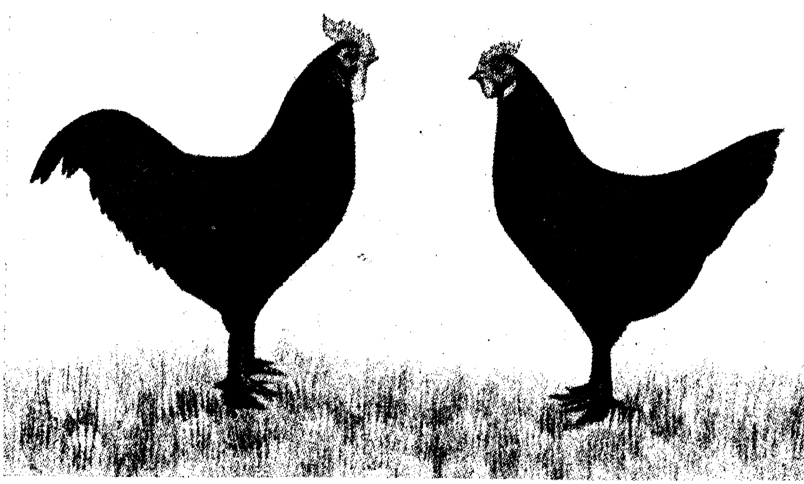


Plate 96.
CHINESE LANGSHANS.

CHINESE LANGSHANS (Plate 96).

General Characteristics.

THE COCK.

Head.—Skull small and full over the eyes. Beak fairly long and slightly curved. Eyes large. Comb single, medium size, straight and upright, showing good clearance back of head, free from side sprigs, evenly serrated with five or six spikes of fine texture. Ear-lobes and wattles medium size. Face to be clean.

Neck.—Of medium length, with a full flowing hackle.

Body.—The back fairly broad, flat, of medium length, saddle abundantly furnished with hackles; breast fairly deep and well-rounded from shoulder to shoulder, not flat; breast-bone straight, with keel level. Wings of medium length, closely carried.

Tail.—Of medium size, carried gradually up and outwards to an angle of about 35 degrees, and medium width, fairly close, furnished with plenty of tail coverts and two secondaries and two sickle feathers slightly longer.

Legs.—Thighs medium length covered with short soft feathers. Shanks of medium length, small-boned, standing well apart and feathered down the outer sides (not too heavily or too scantily).

Feet.—Toes (four) straight, slender, and well-spread, the outer toe being feathered.

Carriage.—Graceful, neat, and extremely active.

THE HEN.

The general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Colour.—Beak light to dark-horn, not white. Eyes dark-brown. Face free from feathers. Wattles and ear-lobes to be brilliant red. Legs and feet blue-black, showing pink between the scales; the web and bottom of feet pink-white (the deeper the pink the better); toe-nails white.

Plumage.—Dense black with a brilliant beetle-green gloss free from purple or blue tinge, medium texture, not too tight like the Game, not so loose as the Cochin.

Weight.—Cock, 6½ lb.; cockerel, 5½ lb.; hen, 5½ lb.; pullet, 4½ lb. minimum.

Eyes.—Dark-brown or black.

Serious Defects.—Yellow legs; white beak or yellow eyes; five toes; permanent white in the ear-lobes; slate or blue legs in young birds; white feathers; vulture hocks; wry tail; squirrel tail; lop combs; side sprigs; crooked breast-bone amounting to deformity. Deduct up to 5 points for feathers on middle toes. It might be added that the female shape should be free from lumpy or squat appearance, and that the back should be devoid of cushion or fullness at saddle.

The Langshan undoubtedly originated in China, where it has been bred for centuries. The name is derived from the district of Langshan, in China. Major Croad, after whom a variety is named, first introduced this breed into England in 1872. The first introduction of Langshans into Australia is unknown.

Langshans are good table fowls, and the variety known as Chinese or Australian is noted for its egg-laying qualities. This variety has proved itself by repeatedly laying the highest number of eggs in the heavy breed sections of egg-laying competitions. In this regard it is quite comparable with the Australorp. The breed is not so popular as the Australorp, possibly because of the fact that the birds are smaller.

The Chinese Langshan is a very compact bird, exceptionally alert and active, whilst the feathering is fairly close or tight. The face is usually exceptionally free from feathering and bright red—a good feature that should not be overlooked when selecting breeding birds.

The standard calls for black plumage with beetle-green sheen. As this is not difficult to obtain, birds with purple or bluish sheen should not be used.

Common faults that may be found are light-coloured eyes, feathers on the middle toe, and white feathers. These are features which should be guarded against in the selection of breeding birds.

RHODE ISLAND REDS (Plate 97).

General Characteristics.

THE COCK.

Head.—Skull strong but not thick. Beak curved, moderately long. Eyes large and bright. Comb (*a*) single or (*b*) rose; (*a*) medium size, upright, straight and firmly set, with five even serrations; (*b*) low and firm, oval top covered with small points and terminating in a small spike, following the curve of the head. Face smooth. Ear-lobes fine texture, well developed and pendant. Wattles of medium size and moderately rounded.

Neck.—Of medium length and profusely covered with hackle flowing over the shoulders, but not too loosely feathered.

Body.—Fairly deep, broad and long, but a distinct oblong rather than square; broad and full breast; long back, horizontal except where the neck hackle flows over the shoulders and the saddle gently rises; large wings well folded and the flights horizontal; fairly small tail, sickles passing a little beyond the main feathers, well spread, and carried somewhat low (but by no means drooping) to increase the apparent length of the bird.

Legs.—Of medium length; large thighs; well-rounded shanks free from feathers. Toes (four) straight, strong, and well spread.

Carriage.—Alert, active, and well balanced.

Weight.—8½ lb., cockerel, 7½ lb.

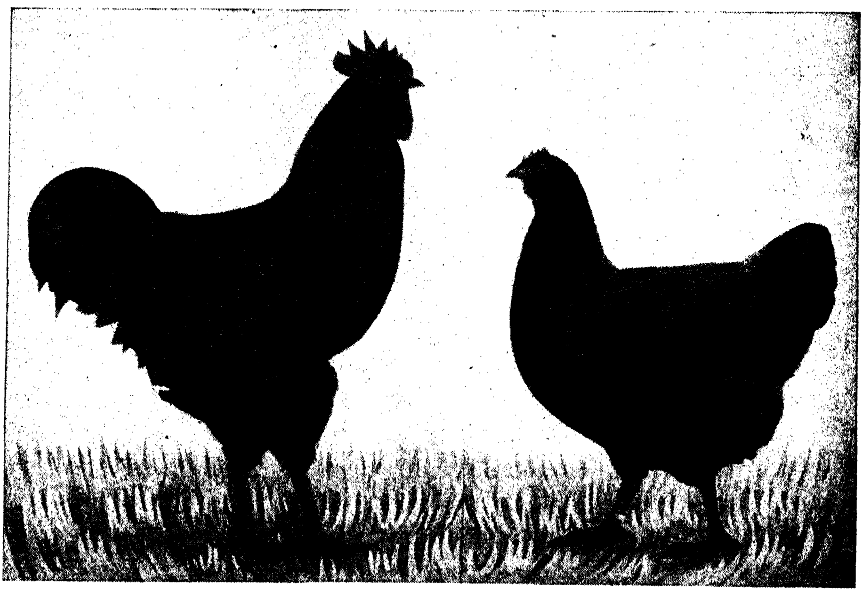


Plate 97.
RHODE ISLAND REDS.

THE HEN.

The general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—6½ lb.; pullet, 5 lb.

Colour.

Beak red-horn or yellow. Eyes red. Comb, face, ear-lobes, and wattles brilliant red. Legs and feet yellow or red-horn.

Plumage of Cock.—Hackle red, harmonising with the back and breast. Wing primaries, lower web black, upper red; secondaries, lower web red, upper black; flight coverts black; bows and coverts red. Tail (including sickles) black or green-black; coverts mainly black, but may be russet or red as they approach the saddle

Remainder, general surface rich brilliant red, except where black is specified, free from shafting, mealy appearance, or brassy effect; depth of colour (red) is slightly accentuated on wing bows and back, but the least contrast between these parts and the hackle or breast the better, a harmonious blending desirable. The bird should be of so brilliant a lustre as to have a glossed appearance. The under-colour and quills of the feathers should be red or salmon. With the saddle parted showing the under-colour at the base of the tail, the appearance should be red or salmon, not white or smoke. Black or white in the under-colour of any section is undesirable. Other things being equal, the specimen having the richest under-colour shall receive the award.

Plumage of the Hen.—Hackle red, the tips of the lower feathers having a black ticking but not a heavy lacing. Tail black or green-black. Wings as in the cock. Remainder, general surface lighter and more even than in the male, free from shafting or mealy appearance, and except where black is specified a rich even shade of bright red, not as brilliant a lustre as the male. The under-colour and quills of the feathers should be red or salmon. Black or white in the under-colour of any section is undesirable. Other things being equal, the specimen having the richest under-colour shall receive the award.

Scale of Points.

Colour (plumage, &c., 25, eyes 5)	30
Type, including size	30
Quality and texture	15
Head	10
Condition	10
Legs	5
	100

Serious Defects.—Feather or down on shanks or feet, or unmistakable indications of a feather having been plucked from the same; badly lopped combs, side sprig or sprigs on the single comb; entire absence of main tail feathers; two absolutely white (so-called wall or fish) eyes; a feather entirely white that shows in the outer plumage; an ear-lobe showing more than one-half the surface permanently white (this does not mean the pale ear-lobe, but the enamelled white); shanks and feet other than yellow or red-horn; any deformity.

The Rhode Island Red is an American breed which originated on the shores of Narragansett Bay, in the State of Rhode Island. The farmers in that district, with the object of improving the vigour and table qualities of common farm flocks, engaged in crossing. The birds introduced for this purpose were Cochin, Brown Leghorn, Malay, and Wyandotte. The result of crossing and selection evidently interested serious-minded breeders in the bird, with the result that in 1901 a standard was drawn up and in 1904 the breed was admitted to the American standard of perfection.

An outstanding character of the Rhode Island Red is its constitution, the bird being of a very hardy nature. It possesses excellent table qualities and matures fairly rapidly, although chickens hatched later than August appear to lag. This may be a matter of individual strain. Although the breed is used extensively in some parts of the world for commercial purposes, such is not the case in Queensland. It has been, in the main, a fancier's bird. Colour and size as aimed for on the show bench are probably responsible for the fact that less effort has been made to improve its prolificacy. It is a breed well worth greater attention being given to its production ability by commercial breeders.

In breeding, select standard weight birds. Oversized birds are invariably poor producers, and as there appears a tendency for the breed to revert to the smaller-sized birds of its ancestry, under-sized birds should not be used.

The body of the Rhode Island should approach in shape a rectangle. It should be carried level and the line of the back kept horizontal. The wings should have no tendency to drop but should be carried on a level with the back. The back should be flat from front to rear and

also from side to side. It needs to be wide, and the width carried the full length of the body. The breast should be full and prominent to fill in the rectangular shape. A perpendicular line from the breast should meet the base of the beak. The bird should be well balanced, with legs under the centre; shanks fairly stout and of medium length, stiltiness to be avoided.

Colour of eye in females tends to fade with production, and some good-eyed birds as pullets will have pale or greenish eyes as hens. Old birds with good eye colour are most valuable breeders. Select against dark or blackish streaks in beaks, as this fault is troublesome. Do not breed from extremely dark males, as females from this mating will invariably be mottled. Matings should consist of rich snappy coloured males of even shade in hackle, wing-bows, and saddle, and females which are dark rich and even in colour. In addition to depth of colour the plumage should be lustrous bright and alive and not a dead brown or chocolate.

With age white may appear in the back and saddles of males, but if the bird was sound as a cockerel it is not a very serious defect. Very few hens approach closely their pullet colour. Those that do are most desirable breeders.

[TO BE CONTINUED.]

Protecting Infants From Disease.

Danger From Flies.

THE dangers arising from the housefly are due to its promiscuous feeding habits and its intimate association with man. It will walk over and feed upon the faecal desposits in a privy, the refuse in a garbage can, the pastries in a cake shop and the food in the kitchen and pantry with equal impartiality and in turn will convey infective agents secured from the excreta to food during its journey. Hence it is often responsible for the spread of such intestinal infections as typhoid, dysentery and gastro-enteritis. Therefore it is imperative that you do all that is humanly possible to keep the fly menace at bay and there are several weapons at your disposal.

The fly breeds mainly in manure piles, including human faeces, and in decaying vegetable matter. Its entire life cycle is usually completed in from ten to fourteen days and therefore open and exposed manure heaps should not be permitted to represent over a week's accumulation, and the same applies to garbage. Another solution to this problem is afforded by the treatment of manure piles with substances which destroy the larvae. Stables and cow sheds should have tight floors and be well cleaned.

Trapping and otherwise catching the adult flies, particularly if practised at the beginning of the breeding season, if of distinct merit. Sticky fly paper and the swatter should be used in every home and eating house, and the screening of all doors and windows is another useful method of keeping flies at bay. There are also various lethal sprays containing DDT and other substances, and these provide another effective method of attack.

The activity of flies as conveyors of disease organisms from excreta gives opportunity to reiterate the importance of collecting human excreta in privies that are of *fly-tight* construction. It is essential to keep baby well protected from flies and other insects, so don't forget to cover his cot, basinette or pram with a net at all times. Anything that goes in baby's mouth should also be kept scrupulously clean and protected from contamination.

All foodstuffs and baby's milk imperatively must be kept covered with some dustproof material and stored in a cool, airy place. All milk and water intended for baby's use should be boiled and all receptacles scalded before use.

—Maternal and Child Welfare Service.

ASTRONOMICAL DATA FOR QUEENSLAND.

APRIL, 1950.

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Date.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5.57	5.47	Cairns	21	37	Longreach ..	31	39
6	6.00	5.41	Charleville	26	28	Quilpie	36	34
11	6.03	5.35	Cloncurry	44	56	Rockhampton ..	7	14
16	6.05	5.31	Cunnamulla ..	30	28	Roma	16	18
21	6.08	5.26	Dirranbandi ..	20	18	Townsville ..	18	32
26	6.10	5.21	Emerald	15	23	Winton	35	44
30	6.12	5.18	Hughenden ..	29	41	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Date.	Rise.	Set.
	p.m.	a.m.
1	4.47	3.47
2	5.21	4.52
3	5.57	5.59
4	6.35	7.08
5	7.18	8.19
6	8.07	9.31
7	9.02	10.42
8	10.03	11.48
		p.m.
9	11.07	12.47
10	..	1.37
	a.m.	
11	12.10	2.20
12	1.12	2.56
13	2.10	3.27
14	3.06	3.56
15	3.59	4.23
16	4.52	4.50
17	5.44	5.18
18	6.37	5.48
19	7.32	6.21
20	8·28	6 58
21	9.24	7.41
22	10.20	8.29
23	11.14	9.23
	p.m.	
24	12.04	10.21
25	12.49	11.23
26	1.30	..
		a.m.
27	2.07	12.45
28	2.42	1.27
29	3.15	2.31
30	3.49	3.26

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19; Quilpie 35; Roma 17; Warwick 4;

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	17	23	32	39	8	14	37	44
6	30	11	45	25	20	0	53	28
11	29	12	44	26	19	1	52	29
16	18	21	34	38	9	12	38	43
21	10	30	25	45	0	21	27	53
26	12	26	27	42	2	17	30	49
30	21	19	37	35	12	10	43	39

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	24	37	46	56	31	41	21	32
3	37	24	55	46	40	32	31	21
5	48	11	63	38	48	23	40	11
7	56	3	68	32	52	18	46	4
9	55	2	68	32	51	17	45	3
11	52	8	66	36	50	21	43	8
13	42	19	58	43	43	28	35	17
15	32	29	52	50	36	35	26	25
17	21	39	46	57	29	42	18	34
19	12	48	38	62	23	48	11	40
21	5	55	35	67	19	52	5	45
23	1	56	32	67	16	53	2	46
25	6	50	35	63	20	49	6	42
27	16	45	41	60	26	46	14	37
29	27	34	49	54	33	39	23	29
30	34	28	53	49	38	34	28	24

Phases of the Moon.—Full Moon, 3rd April, 6.49 a.m.; Last Quarter, 9th April, 9.42 p.m.; New Moon, 17th April, 6.25 p.m.; First Quarter, 25th April, 8.40 p.m.

On 15th April the Sun will rise and set 10 degrees north of true east and true west respectively and on the 2nd and 15th the Moon will rise and set respectively at approximate true east and true west.

On the morning of 3rd April there will be a total eclipse of the Moon but from Queensland the beginning will be seen only an hour or so before the Moon will set and only a partial eclipse will be seen from this State.

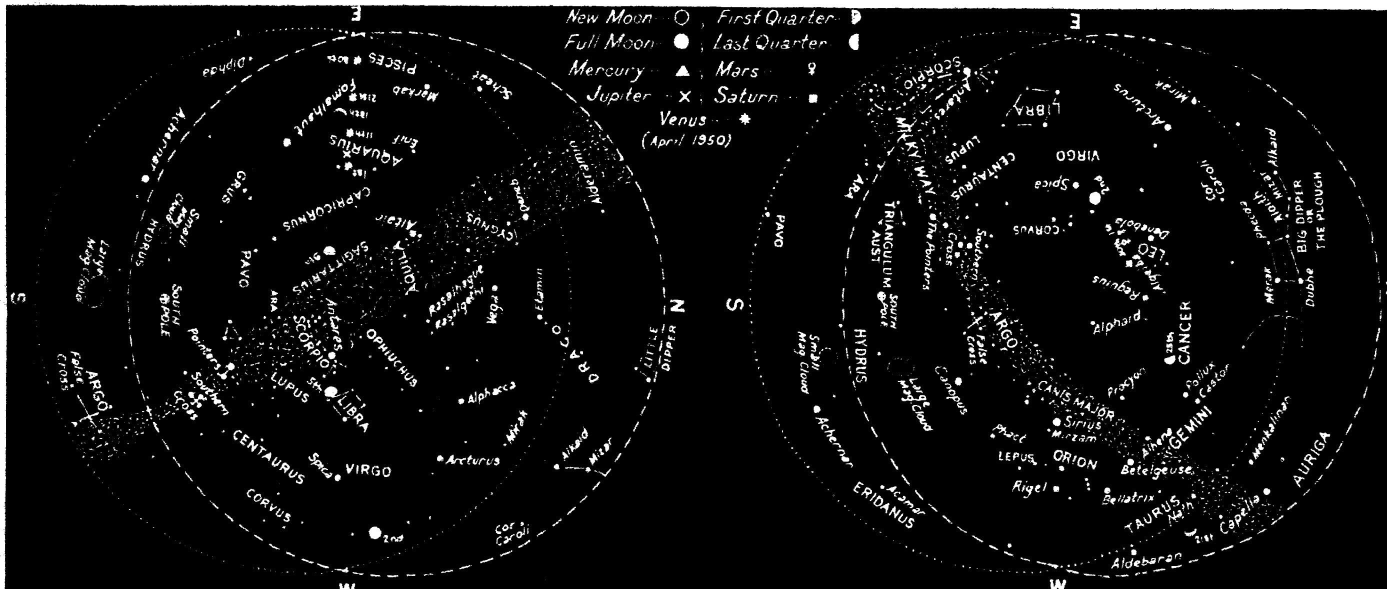
Mercury.—It will remain an evening object all this month. At the beginning, in the constellation of Pisces will set 13 minutes after the Sun and on the 23rd, in the constellation of Aries will reach its greatest angle east of the Sun when it will set nearly an hour after sunset. At the end of the month, in the constellation of Taurus will set 50 minutes after the Sun.

Venus.—On the 11th of this month will reach its greatest angle west of the Sun when it will rise 3½ hours before sunrise. At the beginning and end of the month it will rise 3 hours 25 minutes before the Sun. Before they rise on the 6th, Venus will pass 2 degrees to the north of Jupiter.

Mars.—Which will remain in Virgo during the month, on the 1st will rise half an hour before sunset and at the end of the month will rise during mid-afternoon and set during the early morning hours.

Jupiter.—At the beginning of April, in the constellation of Capricornus, will rise between 2.45 a.m. and 4 a.m. while at the end of the month, in the constellation of Aquarius, will rise an hour or so after midnight.

Saturn.—Now well up in the eastern sky at nightfall. On the first setting 1½ hours before sunrise and on the 30th setting 2 or 3 hours after midnight.



Star Charts.—The chart on the right is for 8.15 p.m. in the south-east corner of Queensland to 9.15 along the Northern Territory Border on the 15th April. (For every degree of Longitude we go west, the time increases by 4 minutes.) The chart on the left is for 8 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales Border. When facing North hold "N" at the bottom, when facing South hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month, the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the Moon and planets which are continually changing in relation to the stars are shown for certain marked days. When no date is marked the position is for the middle of the month.

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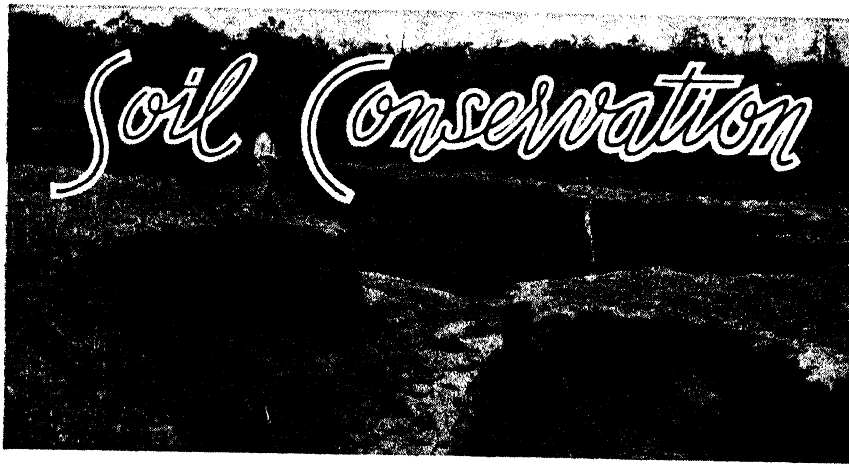
Contents



Soil Conservation in Queensland.

J. E. LADEWIG, Senior Soil Conservationist, and A. F. SKINNER, Soil Conservationist.

3. The Use of Vegetation in Soil Conservation.

PRIOR to settlement, the lands of the State were well covered with vegetation, and under these conditions erosion was limited to a harmless rate. Although it is not possible to restore those original factors and still maintain the present agricultural economy, soil conservation measures must be patterned on the natural conditions which, prior to settlement, reduced erosion to negligible proportions.

This involves the utilisation of close-growing vegetation to the maximum practicable extent in farm operations, the retention of a protective cover on as much of the land as possible for the major part of the year, and the maintenance of the soil organic matter content (Plate 98).

These practices are very effective in controlling erosion because, firstly, they protect the soil from the impact of raindrops, thus ensuring that rain entering the soil is free of soil particles and therefore can penetrate easily; secondly, they check the speed of water flowing on the surface and so reduce its power to transport soil; and thirdly, by increasing the organic matter content of the soil the rapid absorption of rain is facilitated.

Vegetative measures designed to assist in soil conservation are grouped as follows:—

(1) Crop rotation and strip cropping.
(2) Cover-cropping and green manure cropping.
(3) Pasture improvement and management.
(4) Stubble mulching.
(5) Tree planting.

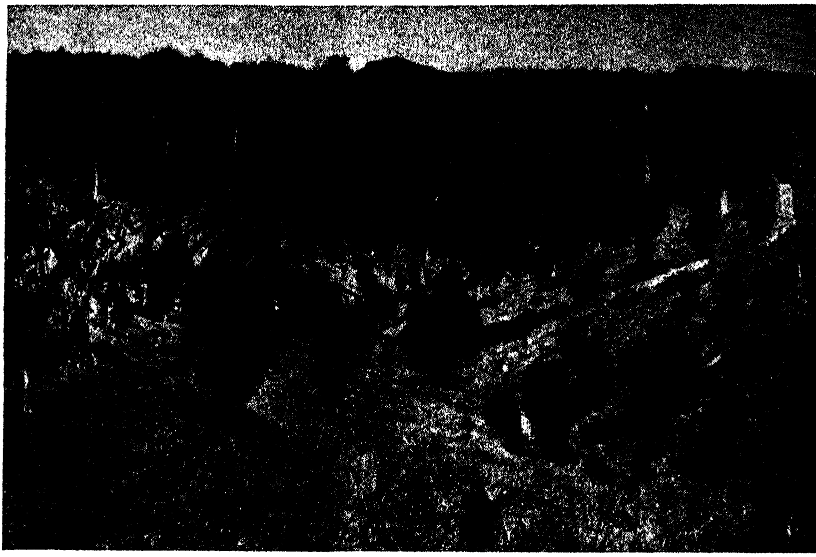


Plate 98.
PROTECTION OF THE SOIL WITH VIRGIN FOREST IN THE BACKGROUND AND A COVER CROP IN THE ORCHARD IN THE FOREGROUND.

CROP ROTATION.

Crop rotation may be described as a more or less regular succession of different crops on a single piece of land. The purposes of rotations are to ensure that the minimum area of land will be under clean cultivation conditions at any one time, to assist in the control of weeds, insect pests and plant diseases, and to aid in maintaining soil structure and fertility.

Crop monoculture has been practised extensively in the agricultural areas of this State, primarily because of the greater returns from the main crops suited to the particular districts, but also because this practice simplifies farm management problems. Where systems of one-crop farming have been practised for an extended period, a deterioration in soil structure can be observed, and there has been a progressive decline in the organic matter content of the soil.

The ability of a soil to withstand cultivation for a period of time without serious deterioration in structure depends largely on the colloidal complex, which is influenced by the organic matter content of the soil.

When a natural vegetal cover is present and a soil remains undisturbed, the rates of accumulation and decomposition of organic matter are approximately equal, and usually a slight net increment in organic matter is observed. The greater aeration of the soil resulting from cultivation tends to accelerate the rate of decomposition in warm climates; therefore, though more organic matter may be returned to the soil by cultivated plants or organic material than that derived from

natural vegetal cover, soil under cultivation tends towards a lower equilibrium of organic matter. Until this new and lower level is reached there is a decline in the accumulated humus stocks of the soil.

The inclusion of annual legumes in crop rotation (as green manure or cover crops) will materially assist in the maintenance of soil fertility, because leguminous crops are able to utilise atmospheric nitrogen, and this nitrogen is eventually returned to the soil as additional nitrate; however, since the rate of decomposition is rapid in tropical and semi-tropical zones, a lower organic matter accumulation can be expected from green manure crops in these areas than in the temperate zones.

When cultivated land is retired to semi-permanent pasture the factors favouring organic matter decomposition are arrested, and humus synthesis becomes possible. The structure-destroying effect of farm implements is temporarily removed, and the extensive root development of the pasturage assists in binding the soil aggregates. The short-term (or ley) pasture therefore assumes an important role in a rotational programme for any of the agricultural areas of the State, firstly because of its value in reducing the erosion hazard, and secondly, because it is the most practical method for improving soil structure and increasing soil organic matter.

The essential features, then, in a rotational programme are the inclusion of—

(1) the main cash producing crop or crops;

(2) annual leguminous crops for the maintenance of soil fertility and protection of the soil;

(3) pasture leys for restoration of structure and maintenance of soil organic matter.

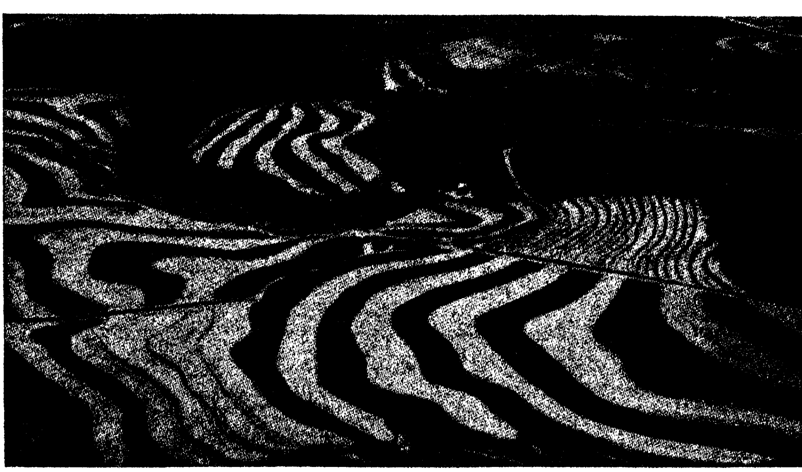


Plate 99.

STRIP CROPPING IN THE UNITED STATES.—Cotton is grown in the cultivated strips and cereals in the alternate strips.

[*Photo. by U.S. Department of Agriculture.*

STRIP CROPPING.

Strip cropping is a system in which farm crops are planted in relatively narrow strips *on the contour*—that is, across the slope of the land—and so arranged that strips of erosion-inducing crops, such as maize, peanuts, or sunflowers, are separated by strips of dense, erosion-resisting crops such as wheat, cowpeas, oats, barley, lucerne, or pasture (Plate 99). Successful strip cropping requires the adoption of a balanced crop rotation programme.

Careful planning is necessary to make the best use of strip cropping practices and to enable the soil protecting legume-grass strips to be grazed without interfering with adjoining strips of clean cultivated crops. In regions with moderate to high rainfall and where the soils erode readily, strip cropping must be supplemented by contour banks. In contour banked fields the width of strips is usually determined by the bank spacing, but in general, to meet the requirements of soil conservation, the strips of clean cultivated land should not be wider than 100 feet.

COVER CROPS AND GREEN MANURES.

Protective cover crops are important in safeguarding fields from erosion; where land is fallowed during summer months, and is subject to damage by high-intensity summer storms, the use of annual legumes can assist materially in reducing erosion losses, and at the same time help in the maintenance of soil fertility. In this case leguminous cover crops should be sown in early summer to provide protection during the dangerous "storm" months and still allow sufficient time to prepare a satisfactory seed-bed for the sowing of the winter crop.

In fruit-growing areas cover crops may be almost continuously used to avoid the exposure of a bare cultivated surface to erosive agencies. Annual legumes are frequently utilised as cover crops during critical periods and later turned under as green manure crops; their value as cover crops is enhanced by their fertility building value. Legumes used for this purpose include cowpeas, pigeon peas, field peas, lupins, and velvet beans.

PASTURE IMPROVEMENT AND MANAGEMENT.

Native pastures are playing a very important role in protecting grazing lands and the upper slopes of agricultural lands, but there is a vast field for improvement in land utilisation by the retirement of steeper arable land to permanent pastures. Where top-soil losses are serious, pastures, while protecting and improving the soil, will often produce greater returns through grazing than are obtained through cropping such land.

Continuous cultivation of steep lands for the growth of annual forage crops, such as oats, barley, Sudan grass, &c., subjects the land to an unnecessary erosion hazard. Retirement of these areas to permanent pasture will prevent further severe erosion; some initial difficulties may be experienced in the determination of suitable grasses for each district, but adaptable species can be found for areas which it is economically feasible to devote to permanent grass (Plate 100). Departmental officers will provide guidance in respect of these matters.

In medium to low rainfall grazing areas of the State, the effectiveness of pasture management practices is conditioned by the frequency of droughts, and favourable results obtained by careful management may often be lost due to the occurrence of a drought, because all available pasture may be grazed bare in order to keep stock alive over a critical period. Despite this, every effort should be made to adopt pasture management practices which will ensure the maximum utilisation of the protective value of grass and, in particular, to retain as much as practicable of the ground mulch of dry grass. Pasture burning is an invitation to soil erosion, because it not only removes the protective cover of standing grasses but also destroys the valuable cover of grass residues.

Plate 100.

AN IMPROVED PASTURE IN SOUTH-EASTERN QUEENSLAND.—Soil losses are minimised and soil fertility and structure are improved when arable land is retired to this type of pasture for three years in ten.

STUBBLE MULCHING.

Farming techniques in the past have consisted of either the complete "turn in" of crop residues or their destruction by firing. The harmful effects of stubble burning are obvious and lead to the associated decline in soil nitrogen and organic matter, but it is only in recent years that it has been realised that complete burial of crop residues may not be entirely beneficial. The soil organic matter content is only slightly increased by this practice and the crop residues are not being utilised for the protection of the vulnerable soil surface. Recent experimentation has shown conclusively that crop residues must be retained on the soil surface if they are to offer adequate protection. As a result, a new system of agriculture is in the course of evolution. It is known as stubble

mulch farming or sub-surface tillage, in which cultivation operations are carried out without burying more than a limited amount of stubble. Special machinery is being evolved to meet this need, and in wheat-growing districts it will shortly be possible to farm continuously beneath a protective mantle of stubble Many farmers by adapting existing farm machinery have been able to retain the maximum of trash as a surface mulch with satisfactory results (Plate 101).

The advantages of stubble mulching are obvious While a surface cover of crop residues can be maintained, high-intensity rains lose much of their danger; the stubble blanket absorbs the energy of the raindrops, which trickle slowly through and are readily absorbed by the soil. Downslope movement of water and soil is impeded by the stubble cover, and moisture losses by evaporation are reduced, enabling crops to survive longer during dry spells.

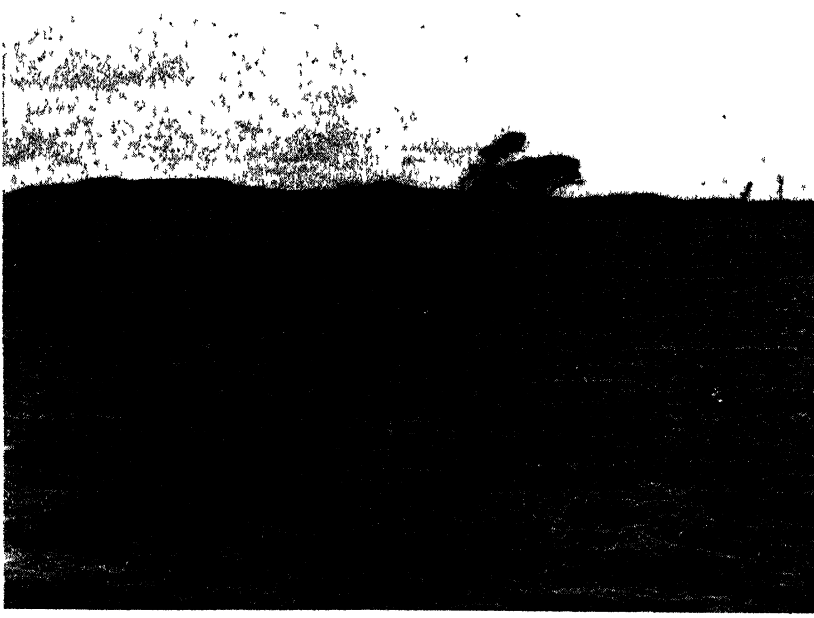


Plate 101.

PERFECT PROTECTIVE BLANKET OF WHEAT STUBBLE AFTER ONE PLOUGHING WITH A SUNDERCUT.—No soil was lost in a 3-inch storm 12 hours before this photo. was taken.

Surface mulching of sloping orchards and vineyards considerably reduces soil and water losses, but in addition will assist in weed control and will ensure the replenishment of the soil organic matter. Under these conditions it is often profitable to grow "stubble" crops in an adjoining area and transport and lay down the mulch by hand. A 4-6 inch depth of mulch is the usual requirement for orchard work to facilitate weed control and to ensure that the process will not have to be repeated too often. Stubble mulching and cover cropping techniques offer the soundest approach to the erosion problem in the steep coastal fruit-growing areas.

TREES.

The comparatively slow rate of erosion in forested areas prior to land settlement is proof of the value of tree cover in preventing erosion. The canopy effect of trees assists considerably in reducing the soil destroying impact of raindrops, but, more important, the mulch cover beneath trees assists water absorption and prevents removal of surface soil. Tree roots bind the soil, and on steep slopes and the sides of watercourses, where the soil can readily slide, tree roots provide the necessary stability. Landslides have often followed the removal of trees on very steep slopes in coastal areas, and the condition can only be corrected by restoring the tree cover.

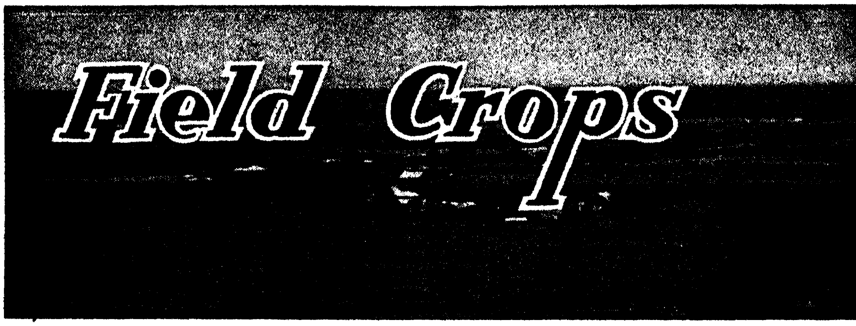
Plate 102.

FARM WOOD LOT PROTECTING THE HOMESTEAD FROM WIND AND ENSURING A PERMANENT SUPPLY OF TIMBER FOR USE ON THE FARM.

[*Photo. by Forestry Sub-Department.*

Tree planting, therefore, finds very wide application in soil conservation work. Wood lots (Plate 102) on every farm ensure a permanence of timber and wood supplies, and a protective shelter for birds and other wild life, so necessary to maintain the biological balance in nature.

The complete retention of all trees should be practised on steep slopes and on the sides of watercourses; ringbarking should be restricted to those areas where stability can be achieved without trees. In areas subject to wind erosion shelterbelts of trees are invaluable in reducing the erosion losses, particularly if they are established in lines at right angles to the direction of the prevailing winds.



A Progress Report on Potato Fertilizer Trials.

W. J. CARTMILL, Senior Soils Technologist, Agriculture Branch.

DURING recent years the Department has conducted a series of fertilizer trials with potatoes in the principal potato-growing areas of the State—namely, the Lockyer Valley, the Fassifern Valley, and the Lower Burdekin districts. The object of these trials is to determine the major plant food requirements of the crop for the principal soil types in the various districts, using the yields of first grade potatoes as the basis of the determinations.

PLANT NUTRIENTS ADDED IN FERTILIZERS.

There are at least 12 plant food elements which are essential for the proper nutrition of plants. Some of these are required in relatively large quantities and are referred to as major plant nutrients; others are required in only very small amounts and are referred to as minor plant nutrients. The latter are present in sufficient quantity for plant needs in most agricultural soils and so do not need to be added as a routine fertilizer practice. Indeed, injurious effects on plant growth may follow a too liberal application of some minor elements. Copper, zinc, boron, and iron are examples of minor plant food elements. The plant foods usually added by applications of ordinary commercial fertilizers are three of the major plant foods (namely, nitrogen, phosphorus, and potassium), because deficiencies of these nutrients are most common in soils. The trials reported here were designed to determine whether there are any deficiencies of these three plant foods in the soils of the principal potato-growing areas.

FERTILIZERS COMMONLY USED.

A fertilizer which supplies nitrogen, phosphorus and potassium is commonly called a complete fertilizer, while one which supplies only one of these plant foods is often referred to as a straight fertilizer. Common examples of straight fertilizers are sulphate of ammonia, which supplies nitrogen; superphosphate, which supplies phosphorus; and muriate of potash, which supplies potassium. A complete fertilizer is usually a mixture of straight fertilizers. It is only necessary to use a

complete fertilizer when the soil is deficient in all three of the above major plant foods. Furthermore, it is not wise to apply fertilizers indiscriminately, as best results are obtained when they are used so that the proportions of the three plant foods in the soil are properly balanced. In other words, the amounts of nitrogen, phosphorus and potassium added to the soil should be such as to make the proportion of each present in the soil suitable for the particular crop. These amounts will vary according to the composition of the soil and the requirements of the crop. For example, a soil inherently high in phosphorus might require only nitrogen and potassium, and the addition to it of a fertilizer supplying phosphorus would not only be a wasteful expenditure of fertilizer but might also upset the balance of the nutrients in the soil so that the maximum benefits from additions of nitrogen and potassium might not be obtained.

THE FUNCTION OF FERTILIZERS AND MANURES.

The purpose of using artificial fertilizers is simply to correct any deficiency of the major plant foods in the soil. They do not make up for other deficiencies such as a lack of organic matter or humus, improper preparation or insufficient cultivation of the soil, or for a lack of moisture. Organic matter has an important function in soils: it supplies humus, which, as well as providing plant foods, has an important effect on the structure or tilth of soils, particularly of heavy soils, keeping them loose, open, and friable, and permeable to water. Organic matter greatly improves the water-holding capacity of light soils. The development of a loamy structure or tilth greatly improves the productivity of potato soils, so that the maintenance of a satisfactory humus content should be an integral part of the fertility maintenance programme of potato soils. The loss of humus is partly made good by the additions of large quantities of organic matter, such as by ploughing in bulky green manures and cover crops and by using liberal quantities of farmyard manure; but to build up the organic matter to any appreciable extent it is usually necessary to put the area into grassland for a period. A dense vigorous cover of pasture for a year or two will make a considerable improvement in soils depleted of organic matter. The loss of mineral plant foods such as phosphorus and potassium must be made up by using fertilizers, and it is often necessary to supplement the nitrogen supply by using inorganic nitrogenous fertilizers even though a green manure has been ploughed under.

FIELD TRIALS.

The most satisfactory way of diagnosing the nature and extent of nutrient deficiencies in a soil for any particular crop is by a properly conducted field trial in which the various plant foods are added to the soil in different quantities both alone and in various proportions. In fact, trials of this kind are necessary to determine the amount of fertilizer to add to a soil to give the most profitable crop response.

Because of differences in the fertility of soils due to differences of type it is necessary, in order to determine the fertilizer requirements of the different types, to establish a number of trials on farms scattered throughout the district. To do this the co-operation of farmers is required and the willingness with which this co-operation has been given in establishing these potato trials is much appreciated by the Department.

Although the trials are set out with care and accuracy there are always some which give no useful results because of damage to the crop by certain diseases or some other uncontrollable factor. Only data from trials which are known to be reliable are used for the purposes of interpreting the results.

The results of trials which have been conducted in the various districts over the last four years are discussed below.

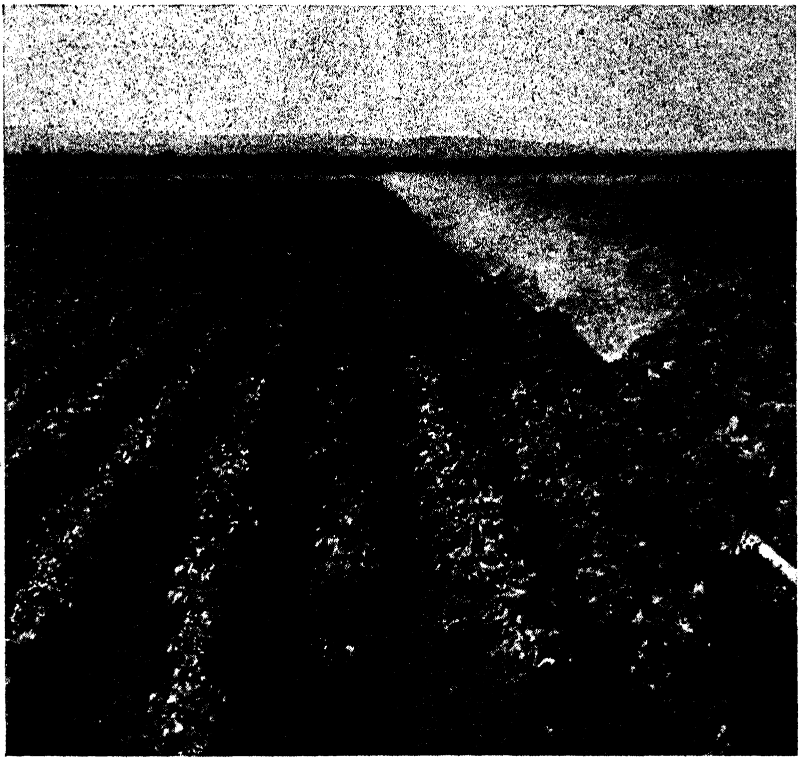


Plate 103.

A POTATO CROP IN THE LOCKYER VALLEY.

TRIALS IN THE LOCKYER VALLEY.

Potatoes are mostly grown in the Lockyer Valley without the use of artificial fertilizers. However, in recent years there has been a growing tendency amongst farmers to apply fertilizers and there is no doubt that in many cases the results have been beneficial. Complete mixtures are mostly used, but it would appear from the results of soil investigations that complete mixtures are not required, while field trials have shown that the beneficial effects of the mixtures can usually be ascribed to only one ingredient of the mixture. Field trials are the ultimate criteria of the soil's fertility status. The Lockyer Valley trials have so far shown that the nutrient which is most frequently deficient in the soils of that district is nitrogen. A few cases of potassium deficiency have been found. Phosphorus, however, appears to be present in ample quantities for plant requirements in all the soils examined.

The results of these trials were as follows:—

Autumn, 1946.

Gatton (M. J. Logan).

The soil type on the site of this trial was a brown-grey alluvial clay-loam. The only response was to sulphate of ammonia, which increased the yield of first grade potatoes by over one ton per acre when it was applied at the rate of 4 cwt. per acre. Superphosphate and muriate of potash had no effect on yield. The result shows that the soil is deficient in nitrogen, but contains sufficient phosphorus and potassium for the needs of the crop.

The mean yields for sulphate of ammonia applications were as follows:—

Sulphate of Ammonia.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	4·43	5·37
2	4·79	5·81
4	5·47	6·51

As the table shows, there was a progressive increase in yield with increasing applications of sulphate of ammonia.

Paree (A. Bachmann).

This trial was carried out on a fairly heavy but friable alluvial soil on Laidley Creek. The response in this case was to potassium. Applications of nitrogen and phosphorus proved to be of no value. The increased yield of first grade tubers from an application of 2 cwt. per acre of muriate of potash was over one ton, which amply repaid the cost of the fertilizer.

Yield data for the muriate of potash applications were as follows:—

Muriate of Potash.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	4·39	4·93
1	4·98	5·50
2	5·45	6·04

It will be seen that there was a progressive increase in yield with increasing applications of muriate of potash.

There was some evidence in this trial that applications of superphosphate lessened the increase in yield due to muriate of potash; that is, that muriate of potash alone gave higher yields than when applied with superphosphate. For example, 2 cwt. of muriate increased the yield by 1¼ tons, but when the same amount was applied with superphosphate the increase was below one ton. This latter effect was probably due to a less favourable balance of the plant foods in the soil resulting from the addition of superphosphate.

A further interesting item of information obtained from the trial was that applications of potash greatly reduced the incidence of target spot. The disease was much more severe on the plots to which no muriate of potash had been added. No doubt this was a factor which contributed to the better yields from the potash-treated plots.

Spring, 1946.

Glenore Grove (V. Staatz).

Good responses to applications of sulphate of ammonia were obtained, indicating that nitrogen was deficient in the soil. There was no other deficiency. Superphosphate and muriate of potash made no difference to the yields obtained. Although the response was very pronounced it is interesting to note that only 2 cwt. per acre of sulphate of ammonia was required to give the maximum yield.

Sulphate of Ammonia.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	3·00	4·53
2	4·46	6·10
4	4·33	5·90

The sulphate of ammonia improved the yield of first grade potatoes by nearly 50 per cent.

Tent Hill (A. Jamieson).

Unfortunately this trial was not satisfactorily established. Although certified seed was used the stand of plants in the plots was very uneven and many plants were stunted. In the circumstances the data obtained were unreliable and cannot be regarded as giving a true picture of the fertilizer responses. Because of the poor stand of plants the average yields were low, that for all potatoes being 2·95 tons per acre, of which 2·07 tons were first grade.

Spring, 1947.

Gatton Irrigation Research Station.

The soil on the site of this trial is a grey-brown clay loam which had not been cropped for some years previously, so that its fertility status was probably better than that of an intensively cropped soil of the same type. A high fertility is indicated by the high total yield, which averaged 9·81 tons per acre. The yield of first grade potatoes averaged 5·05 tons per acre, so that nearly half the yield comprised second grade tubers.

There was no response to sulphate of ammonia or to superphosphate, but there was an indication of a response to potash, which is shown particularly in the figures for total yield.

Muriate of Potash.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	4·81	9·33
1	4·96	9·95
2	5·37	10·16

Autumn, 1948.

The autumn 1948 season was a bad one for potato crops in the Lockyer. The conditions favoured the development of Fusarium wilt and other diseases, which were severe and general throughout the district. The three fertilizer trials which were established were infected in common with the general crop.

Lockrose (C. Siebel).

This crop was severely infected with wilt. Later, heavy rain in May and June introduced late blight and caused rotting of the tubers. Only about 25 per cent. of the harvested potatoes were sound and marketable, so that the yield figures quoted below are much lower than would have been obtained under more favourable circumstances.

A count of plants affected by wilt at an early stage of the infection showed that the disease was less severe in plots treated with the higher potash application (2 cwt. per acre). Another count a month later showed that all plots were then affected to about the same extent. However, the delay in infection of the high potash plots was sufficient to enable the tubers to develop in those plots, so that they eventually gave the highest yield of first grade potatoes. The yields for the potash-treated plots were as follows:—

Muriate of Potash.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	1·13	2·70
1	1·13	2·52
2	1·43	2·65

The effect of the wilt is shown not only in the low total yield but also in the relatively high percentage of second grade tubers, which represent more than 50 per cent. of the total yield.

Because of the poor crop the yield data cannot be taken as an indication of the response to fertilizer under normal conditions.

Thornton (J. Wilson).

Severe wilt infection was general throughout the plots and considerably reduced the plant population and the resultant yield. Consequently no reliance can be placed upon the data obtained insofar as they indicate soil deficiencies. Although some increased yields were obtained for sulphate of ammonia and for muriate of potash, they were too small to be of any significance. The average total yield of sound potatoes was 4·21 tons per acre, of which 3·26 tons were first grade.

Gatton Irrigation Research Station.

As with the other trials conducted during this season, the crop was severely damaged by wilt. The incidence of the disease was so severe that approximately half the plants in the trial were killed. This reduced the yield and spoilt the value of the trial. The total yield was 3·66 tons per acre, the yield of first grade tubers being 3·18 tons.

Spring, 1948.

Gatton Irrigation Research Station.

The crop in this trial was planted in a grey-brown clay loam soil after a green manure had been ploughed under. The plants grew well in all plots irrespective of fertilizer treatment. The yield data showed that there was no response to sulphate of ammonia, superphosphate, or sulphate of potash, so that the soil was not deficient in any plant nutrient. It is probable that the green manure contributed to this result, since green manures add nitrogen to the soil and sometimes make other nutrients more readily available. The average yield of first grade potatoes was 4·21 tons per acre and the total yield 5·39 tons.

Mulgowie (W. Litzow).

There was a marked response to sulphate of ammonia in this trial, but no response to superphosphate or sulphate of potash, indicating that the soil was deficient in nitrogen only. Applied at 2 cwt. per acre, sulphate of ammonia improved the yield by about 30 per cent. The higher application made no further improvement.

Sulphate of Ammonia.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	2·79	3·80
2	3·67	4·78
4	3·60	4·86

This trial also showed that superphosphate applied with sulphate of ammonia lessened the beneficial effects of the latter, a higher yield being obtained with straight sulphate of ammonia than with sulphate of ammonia and superphosphate together. For example, with an application of 4 cwt. per acre of sulphate of ammonia without superphosphate the yield increase of first grade potatoes was 1·74 tons per acre; when applied with 3 cwt. of superphosphate the increase was 0·52 tons; and when applied with 6 cwt. of superphosphate the increase was only 0·17 tons per acre. This is another example which illustrates the importance of having the plant foods in the soil properly balanced.

Upper Tent Hill (H. Natalier).

In this trial also there was a response to sulphate of ammonia and no response to superphosphate or sulphate of potash, so that nitrogen again was the only deficiency.

The following mean yield figures show the response to sulphate of ammonia:—

Sulphate of Ammonia.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	4·82	6·05
2	5·33	6·47
4	5·41	6·57

An application of 2 cwt. per acre of sulphate of ammonia increased the yield by more than ½ ton of first grade potatoes. A heavier application was of little further benefit.

Autumn, 1949.

Gatton Irrigation Research Station.

A green manurial crop of wheat and field peas was ploughed in about three months before planting this trial, which was on the same soil type as the previous trials at the station.

Due to heavy rain in February and subsequent rotting of the setts, the trial was replanted in March. However, the incidence of Fusarium wilt was again severe this year and about half the plants were infected. As a consequence of the wilt and a virus disease the stand of plants was considerably depleted. Nevertheless, the trial is interesting in that it shows the same trend towards an increase in yield for applications of potash as had been found in a previous trial at this Station (Spring, 1947).

Sulphate of Potash (29 per cent.)	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	3·55	4·32
2	3·99	4·77
4	4·01	4·80

No further increase in yield was obtained by applying more than 2 cwt. per acre of the fertilizer.

General Discussion.

The series of trials being conducted in the Lockyer Valley are not yet sufficiently far advanced to give a clear indication of the fertilizer requirements of the Lockyer soils. There are some parts of the Valley that have not yet been covered by trials, while there is no part where a sufficient number of trials has been conducted to give conclusive data. It would be unwise to draw firm conclusions from one or two trials, because there are several factors which are likely to cause local variations in soil fertility. For example, differences in cultural practices, differences in the periods for which the soils have been cultivated, and variations in local topography could cause fertility differences between farms on the same type of soil. It is necessary, therefore, to conduct three or four trials on each of the principal soil types so as to offset the effects of these local variations. However, where such data as are available from the field trials are considered in conjunction with the information available from analyses of soil samples, certain broad general conclusions can be drawn.

The grey-brown soils of the upper part of the Valley covering the area south of Lockyer Creek between Gatton and Grantham show a general nitrogen deficiency, and on these soils potatoes respond well to applications of sulphate of ammonia. About 2-3 cwt. per acre of the fertilizer seems to be a satisfactory application. Possibly a heavy leguminous green manure crop ploughed in prior to planting the potatoes would satisfy some, if not all, of the nitrogen requirements of the crop, and would confer other benefits on these comparatively light

textured soils. The soils are well supplied with the mineral nutrients phosphate and potash in an available form and in field trials have shown no benefits from applications of these plant foods.

Soils somewhat similar in texture and composition occur on Tent Hill, Ma Ma, and Flagstone Creeks, and the available evidence indicates that these soils are also deficient in nitrogen and that potatoes would benefit by applications of sulphate of ammonia. This was shown to be true, for instance, for a field trial at Upper Tent Hill.

The soils in the main part of the Valley are heavier in texture and somewhat variable in composition. Although, in general, they probably have a better nitrogen status than the lighter textured soils, deficiencies of this nutrient are liable to occur, as instanced by the responses to nitrogen obtained in some field trials. However, it is probable that a good leguminous green manure crop would supply the nitrogen requirements of potatoes on these soils.

There are indications that some of these heavier soils may be potash deficient. For example, samples of the Laidley Creek soils in the Laidley-Mulgowie area have been found on analysis to have a low content of available potassium, and potatoes in a field trial in that area responded well to applications of 2 cwt. of muriate of potash per acre. Similarly, soils from some areas in the Lower Lockyer have a fairly low potassium status, and it would not be surprising if these soils respond to potash fertilizers. A trial at Lockrose, for example, showed evidence of such a response.

TRIALS IN THE FASSIFERN VALLEY.

The alluvial soils of the Fassifern Valley closely resemble those of the Lockyer Valley in physical and chemical properties. Similar gradations in texture occur, so that there are some areas where the soils are dominantly good structured friable loams and others where the dominant texture is a light to medium clay. Generally the soils are well supplied with plant foods, though here, as in the Lockyer, a gradual depletion of the organic matter after years of intensive cultivation seems to have resulted in a deficiency of nitrogen in many places, and farmers are now using fertilizers containing nitrogen on an increasing scale.

Although only a few fertilizer trials have been conducted so far in the Fassifern, the evidence obtained strongly suggests a general deficiency of nitrogen in the soils for the potato crop.

Spring, 1946.

Tarome (E. E. Moffatt).

The only response to fertilizer in this trial was to sulphate of ammonia; neither superphosphate nor muriate of potash was of any benefit. Nitrogen was therefore the only nutrient deficient in this soil.

The mean yields from the sulphate of ammonia applications were as follows:—

Sulphate of Ammonia.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	3·89	4·59
2	4·63	5·51
4	4·34	5·31

An application of 2 cwt. of sulphate of ammonia per acre satisfied the deficiency, and no further increase was obtained with the heavier application.

Fassifern Valley (H. Krueger).

There was a marked response to nitrogen also in this trial, though in this case there was a progressive increase in yield with increased applications of sulphate of ammonia. For example, 2 cwt. per acre of sulphate of ammonia increased the yield of first grade potatoes by over ½ ton, and another 2 cwt. further increased the yield by 0.39 tons.

The mean yields were as follows:—

Sulphate of Ammonia.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	4·71	5·78
2	5·26	6·39
4	5·65	6·95

An interesting feature of this trial was that sulphate of ammonia alone gave bigger yield increases than sulphate of ammonia combined with superphosphate. Without superphosphate, the increased yield of first grade potatoes from 4 cwt. per acre of sulphate of ammonia was slightly more than 2 tons; when the same amount of sulphate of ammonia was used with 3 cwt. of superphosphate the yield increase was 0.71 ton; and when used with 6 cwt. of superphosphate only an insignificant increase of 0.03 ton was obtained. This result shows clearly the importance of having the plant foods in the soil properly balanced. An analysis of this soil showed that it is naturally well supplied with phosphate, so that the addition of superphosphate probably made the quantity of this nutrient in the soil excessive in relation to the other nutrients.

Muriate of potash had no effect on yield.

Spring, 1947.

Kalbar (L. Muller).

Here again there was a marked response to nitrogen. In this trial the deficiency was made good by 2 cwt. per acre of sulphate of ammonia, which increased the yield of first grade potatoes by about ¾ ton per acre.

Sulphate of Ammonia.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	4·52	6·56
2	5·25	7·45
4	5·34	7·40

As was found for some other trials, superphosphate had the effect of lessening the yield increases due to sulphate of ammonia; that is, better results were obtained with straight sulphate of ammonia than with sulphate of ammonia and superphosphate together. For example, when 2 cwt. of sulphate of ammonia was used without superphosphate the increased yield of first grade potatoes was 1.41 tons per acre; when used with 3 cwt. of superphosphate the corresponding increase was 0.70 ton; and with 6 cwt. of superphosphate the increase was only 0.36 ton. This is another example of what occurs when the nutrients in the soil are not properly balanced.

Gap View, Tarome (J. J. Dwyer).

Special interest is attached to this trial because it not only gave large responses to sulphate of ammonia but also responded to superphosphate. The response to both fertilizers increased progressively with increased applications, as shown in the following table.

Treatment.	First Grade Potatoes.	First and Second Grade Potatoes.
	(Tons per acre).	(Tons per acre).
Nil	4·14	6·08
2 cwt./ac. Sulp. of Am. ..	6·31	8·26
4 cwt./ac. Sulp. of Am. ..	7·02	8·93
Nil	4·14	6·08
3 cwt./ac. Superphosphate ..	4·52	6·62
6 cwt./ac. Superphosphate ..	5·17	6·95

The increased yield resulting from an application of 2 cwt. per acre of sulphate of ammonia was over 2 tons per acre of first grade potatoes. Another 2 cwt. of the fertilizer added a further ¾ ton to the yield. Superphosphate at 6 cwt. per acre increased the yield by about one ton. The combined effect of 4 cwt. of sulphate of ammonia and 6 cwt. of superphosphate per acre approximately doubled the yield of first quality potatoes.

The response to superphosphate in this trial is regarded as extraordinary because an analysis of the soil showed that it is liberally supplied with available phosphate—more than would be regarded as sufficient for the needs of the crop. Moreover, in all the other trials so far conducted on soils well supplied with phosphates there has been no indication of any response to superphosphate. A likely explanation of this abnormal behaviour is that some plant food, other than phosphate, is deficient in the soil and was supplied unintentionally in the superphosphate. It is found that lucerne, for example, sometimes responds to superphosphate on phosphate-rich soils, but the effect is apparently due to sulphates in the superphosphate.

General Discussion.

All four trials so far conducted in the Fassifern Valley have shown a response to nitrogen, so it is probable that a deficiency of nitrogen is fairly general in the district. In this respect the soils resemble the lighter textured soils of the Lockyer Valley. To remedy the deficiency, nitrogenous fertilizers should be applied, and sulphate of ammonia at 2-3 cwt. per acre can be expected to give satisfactory results. A dense growth of a leguminous green manure would probably also correct the deficiency and incidentally improve the soil in other ways. Since the deficiency of nitrogen has probably arisen through a depletion of the organic matter in the soil as a consequence of years of cultivation, it would be a sound practice to include green manures in a regular rotation in the cropping programme to offset further losses of this important soil ingredient.

Phosphatic fertilizers are not considered to be required. Although one trial did show a response to superphosphate, this result was probably abnormal.

Potash fertilizers have not given any response so far.

TRIALS IN THE LOWER BURDEKIN.

Potatoes had been grown in the Lower Burdekin for some years before the recent world war, but during the war years a rapid expansion of the industry occurred to meet a wartime demand. The importance of the industry has been maintained and the Woodstock-Ayr district now contributes largely to the requirements of the North Queensland potato market. Fertilizers have an important place in the culture of the crop, and based on the results of some early experiments a fertilizer mixture was formulated and adopted as the standard potato fertilizer mixture for the district. This mixture consists of approximately equal parts of sulphate of ammonia and superphosphate and has the approximate formula 10:10:0. In general it has been giving satisfactory results. However, in view of the fact that the soils of the Lower Burdekin are mostly inherently well supplied with available phosphate, as well as potash, but are low in available nitrogen, it was felt that further experimentation over a wide range of soils might well show that some modification of this formula would be justified; and by getting a better balance of plant foods in the soil enable a more profitable net return to be obtained from the use of fertilizer. Accordingly a series of trials designed to give information on the requirements of the potato in respect to the three major plant foods (nitrogen, phosphorus, and potassium) in the principal soil types of the district was commenced in 1946.

1946 Season.

Clare (E. Granshaw and Sons).

This farm is located on a levee bank of the Burdekin River, where the soil type is a light brown-grey fine sandy loam.

No response to fertilizer was obtained in this trial. On the contrary there was an indication that the heavier application of superphosphate caused a small decrease in yield. The mean yield for the plots without superphosphate was 5.12 tons per acre of first grade potatoes and the corresponding yield for those treated with 6 cwt per acre of superphosphate was 4.56 tons.

This trial was set out on an area that had grown potatoes in each of the previous four seasons. Since it is probable that a commercial fertilizer mixture was used each season it is reasonable to suppose that there would be some accumulation of mineral plant food, especially phosphate, in the soil, and this might have had some effect on the results obtained.

1947 Season.

Clare (E. Granshaw and Sons).

In this year a response to nitrogen was obtained which, although not large, was nevertheless significant and more than paid for the cost of the fertilizer applied as sulphate of ammonia at 4 cwt. per acre. The data showed a small progressive increase in yield as the applications of sulphate of ammonia were increased.

Sulphate of Ammonia.	First Grade Potatoes.
(Cwt. per acre).	(Tons per acre).
Nil	3·06
2	3·28
4	3·47

As was found in the 1946 season trial on this farm, the heavier application of superphosphate tended to depress the yield. In the 1947 trial the effect of superphosphate was to offset the beneficial effect of sulphate of ammonia, when the two were applied together. For example, 4 cwt. per acre of sulphate of ammonia without superphosphate increased the yield by 0.69 ton; when applied with 3 cwt. of superphosphate the increase was 0.66 ton; but when 6 cwt. of superphosphate was used the sulphate of ammonia made no improvement to the yield.

Potash applications did not have any effect on the yields.

Home Hill (B. Rubiola).

The effect of fertilizers in this trial was not clear, although it was fairly definite that there was no response to sulphate of ammonia. There was evidence that the high applications of superphosphate depressed the yield, as was found in the trials on Messrs. Granshaw & Sons' farm. The mean yields tabulated below illustrate this trend.

Superphosphate.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	5·0	6·3
6	4·6	5·8

The effect of muriate of potash was indefinite, although there was a trend towards an increase in yield when applied at the rate of 1 cwt. per acre. A lighter application at ½ cwt. per acre had no beneficial effect.

1948 Season.

Clare (E. Granshaw and Sons).

This trial gave different results from either of the two previous trials on this farm, inasmuch as neither sulphate of ammonia nor superphosphate had any significant effect, while muriate of potash at the rate of 1 cwt. per acre lessened the yield obtained by the significant amount of ½ ton per acre. The following table shows that the yields were gradually depressed as the muriate of potash applications increased.

Muriate of Potash.	First Grade Potatoes.
(Cwt. per acre).	(Tons per acre).
Nil	5·23
0·5	4·86
1·0	4·70

As no similar effect for muriate of potash had been shown in the previous trials on this farm it would be unwise to draw any conclusions at this stage on the behaviour of potash in this soil.

Ayr Regional Experiment Station.

The benefits of sulphate of ammonia applications to the grey silt loam soil at the Regional Station were quite definite. The increase in yield for only 2 cwt. per acre of sulphate of ammonia was over one ton per acre of first grade potatoes.

Sulphate of Ammonia.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	3·23	4·33
2	4·32	5·76
4	4·58	6·57

While there was a large increase in yield for 2 cwt. of sulphate of ammonia, a higher application at 4 cwt. per acre only slightly further increased the yield of first grade potatoes but caused a fairly substantial increase in yield of second grade tubers, as is indicated in the third column of the table.

Superphosphate and muriate of potash had no significant effect on yield.

1949 Season.

Ayr Regional Experiment Station.

As in the previous season's trial at this Station, a response was obtained to nitrogen applied as sulphate of ammonia. Again no benefit was derived from applications of superphosphate or muriate of potash.

The responses to nitrogen are shown in the following table:—

Sulphate of Ammonia.	First Grade Potatoes.	First and Second Grade Potatoes.
(Cwt. per acre).	(Tons per acre).	(Tons per acre).
Nil	3·84	4·55
2	4·52	5·41
4	4·88	5·77

From the two trials conducted at the Station it seems clear that the soil there is deficient in nitrogen, but contains sufficient phosphorus and potassium for potatoes. The amount of sulphate of ammonia required to correct the deficiency of nitrogen seems to be between 2 cwt. and 4 cwt. per acre, so that probably 3 cwt. would be about the optimum.

General.

From the results of the trials so far conducted in the Lower Burdekin and reported here, it is evident that the position in regard to the fertilizer requirements of the potato crop needs further clarification. Several more trials must be conducted on a number of different properties before a satisfactory assessment can be made of the nutritional requirements of the various soil types in the district. Although some of the trials have given erratic results, there is some evidence to indicate that nitrogen is likely to be a major plant nutrient deficiency in relation to potatoes in the Lower Burdekin soils. So far added phosphorus has not been shown to be of any benefit, while the effect of potassium is as yet rather vague.

CARE IN POTATO DUSTING.

A warning against using BHC (benzene hexachloride) for protecting potatoes from insect attack, whether the tubers are in the field or in storage, has been issued by the Science Branch of the Department.

The warning is given because, as previously pointed out by the Department, even small amounts of BHC coming into contact with foodstuffs may affect their flavour.

There are a number of dusts now on the market containing mixtures of BHC, DDT and other insecticides, and instances have occurred where mixed dusts containing BHC have apparently been used as substitutes for straight DDT in insect control, with resultant tainting and economic loss.

In advising growers and others concerned to rely solely on straight DDT, it is pointed out that dusting with 2 per cent. DDT has proved widely successful in Queensland in preventing tuber moth damage in stored potatoes.

Horticultural Districts of Queensland.

3. The South Coast.

J. McG. WILLS, Senior Adviser in Horticulture.

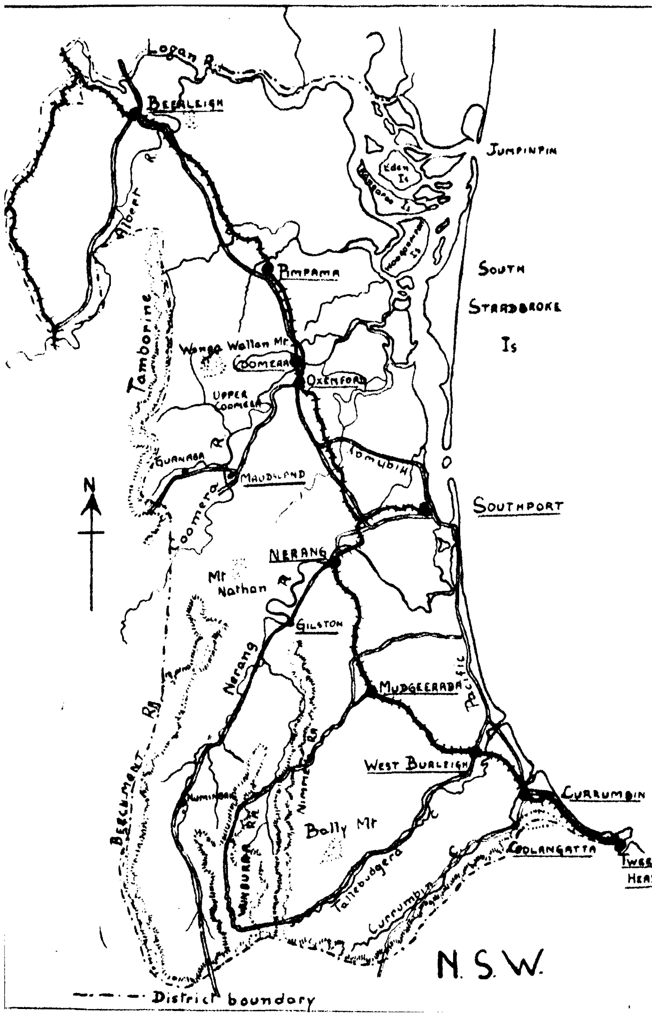
THE South Coast horticultural district is a tract of country extending from Coolangatta on the Queensland-New South Wales border to the Logan River some 20 miles south of Brisbane. It is bounded on the east by the Pacific Ocean, on the south by the Macpherson Range, which forms the southern starting point of the Main Dividing Range, and on the west by the Darlington Range. The district is 52 miles long and relatively narrow, with sharp contrasts in elevation (See map). The fertile plateaux of Springbrook, Binna Burra and Beechmont are 1,000 to 2,000 feet high, while the adjacent alluvial flats and coastal plains are only a few feet above sea level. As would be expected from its topography, the district is well watered by several streams and rivers, chief among which are Currumbin Creek, Tallebudgera Creek, Mudgeeraba Creek, and the Nerang, Logan and Coomera Rivers. Some of these creeks and rivers are bordered by extensive alluvial flats in their lower reaches. Between adjacent river systems, high spurs run from the main range towards the sea.

The more important towns are Coolangatta, Currumbin, Burleigh Heads, Southport and Beenleigh. The first four of these lie on the sea front and attract large holiday crowds from both the north and south. Beenleigh is further inland, more typically rural and serves the requirements of farmers in the northern part of the district.

The broken character of the country and the variety of its soils, aspect and elevation may account for the range of crops which can be grown successfully by farmers familiar with the horticultural needs of each.

CLIMATE.

In common with that of most other parts of southern Queensland, the climate near the coast is sub-tropical without extremes of either heat or cold. At Southport, the mean maximum temperature in January is 84 deg. F., while the mean minimum temperature in July, the coldest month, is 48 deg. The high plateau country is, of course, cool temperate in character. Severe frosts are unusual, but they do occur on the coastal flats, which collect and hold cold air flowing down the ranges



SKETCH MAP OF THE SOUTH COAST HORTICULTURAL DISTRICT.

and associated spurs during the winter months. Some judgment is, therefore, required from the farmer in selecting areas for the cultivation of frost-susceptible plants such as bananas, tomatoes and beans.

The coastal strip has an average rainfall each year of approximately 55 inches, but the plateau and higher spur country may receive twice this amount. Most of the rain falls during the summer period (January to March), winter and spring being relatively dry. The rainfall during the autumn and winter months in many parts of the district is barely sufficient to meet the needs of short-term fruit and vegetable crops, and irrigation facilities considerably reduce normal farming risks at that time of the year.

Heavy rains accompanied by high winds may occur during the monsoonal period of January to April. These can be very destructive on hillside farms if erosion control measures are not practised and the crops are exposed.

Cold westerly winds during the winter months are for the most part diverted from the southern part of the district by the ranges and their associated spurs, but, even so, care is needed in selecting a site for bananas and other crops if cold injury is to be avoided.

Rainfall and temperature observations for Southport are summarised in Table 1.

TABLE 1.

CLIMATIC DATA—SOUTHPORT DISTRICT.

Month.	Mean Maximum Temperature.	Mean Minimum Temperature.	Average Rainfall.
	°F.	°F.	Points.
January	83·8	67·4	715
February	83·2	68·1	676
March	81·2	65·5	802
April	78·2	60·7	535
May	73·0	54·7	528
June	69·3	51·6	366
July	68·9	48·5	307
August	70·9	49·1	207
September	74·4	53·3	273
October	77·8	58·7	280
November	80·9	62·8	364
December	83·0	65·5	498
Yearly average	77·0	58·8	5,551

SOILS.

A variety of soil types is represented in the district. Except where basaltic and other spurs reach to the sea, sand dunes and mangrove swamps are typical of the coast. Behind these lie extensive areas of low, badly drained land carrying a flora of the wallum type. This type of country is not extensively used for horticultural purposes at the present time, but small crops can be grown on the better drained light-grey sands if irrigation is practicable and fertilizers are liberally applied. In some parts of the district, these light, infertile soils edge into shallow, heavy, black clay loams which are intersected by swamps. They overlie an impervious clay band at depths of 8 inches to 1 foot and the water-table is high. Water channels are, therefore, necessary in some areas to ensure adequate drainage. Some of these soils are very fertile, and show peaty characteristics in the vicinity of Merrimac and Pimpama Island. The peaty soils are under pasture at present; the adjacent soils, containing less organic matter, are assigned to agricultural crops such as sugar cane and arrowroot. If irrigation were practicable and drainage adequate, these areas would be very suitable for the production of truck crops. Unfortunately, the plentiful supplies of underground water are brackish and suitable only for stock. There is little possibility of getting good irrigation water from the rivers and creeks, for these are subject to tidal influences for a considerable distance inland. Major irrigation works would be needed to make large-scale irrigation feasible.

Plate 104.
A BANANA PLANTATION ON THE HILLS OF THE UPPER COOMERA.

The production of horticultural crops is, however, located mainly on the loams and clay loams developed on the coastal ranges (Plate 104). The red-brown loams and clay loams derived from sedimentary rocks usually overlie a red-brown clay. These soils are fairly deep and are often strewn with surface boulders. In some areas, such as West Burleigh and on the plateau country, the soils overlie basalt and vary from red clay loams to brown clay loams. They are usually deep and porous and respond well to rain, but dry out fairly quickly. Most of these clay loams erode easily on the steeper slopes and in some areas the topsoil has been lost within a few years of the land being cleared for bananas or some other crop.

While the fertility of the soils on these slopes is good, precautions against erosion losses are essential. Soil management is, therefore, the paramount concern of the fruit and vegetable grower and this may explain the current interest in contour planting, green manuring and drainage problems.

VEGETATION.

Near the coast, the principal timbers are the swamp or semi-swamp species—tea-tree, she-oak, wattle, blue gum and banksia. Towards the foothills, where the rainfall is heavier, the tree cover is very varied, the moist slopes supporting a mixed flora of softwoods and hardwoods in which grey gum, silky oak, blue fig, flooded gum and hoop pine are represented. This semi-jungle carried an undergrowth of vines and has been invaded by lantana, an introduced plant which is very aggressive. The windswept and exposed ridges invariably support forest eucalypts such as bloodwood, ironbark and stringybark in an open forest association.

The basaltic plateau country of the ranges, where the soil is rich and the rainfall heavy, carried rain forest from which a great deal of excellent millable timber has been drawn. The readily accessible areas have now been cleared but the original forest cover still stands in some of the more remote localities as well as in National Parks and catchment zones controlled by water authorities.

HORTICULTURAL USES.

Although most tropical and subtropical fruits can be and are grown on the South Coast, the district is best known as an important banana producing area. The topography of the country is, however, so varied that sheltered frost-free situations are available for other horticultural crops.

Plate 105.
A GREEN MANURE CROP AMONG LADY FINGER BANANAS AT PIMPAMA.

Bananas.

Banana growing on a commercial scale began on the South Coast in the 1920's, and a high level of production has been maintained ever since. Plantations are normally established on virgin rain forest and open forest soils. Under such conditions, the profitable life of the crop is about eight years, but if the plantation is properly managed this period can be extended a great deal. The essential features of good plantation management are soil conservation—principally contour planting and summer green manuring—fertilizer applications adequate to the needs of the crop, and rigorous control of the virus disease bunchy top. The importance of this disease is recognised by the special legislation in force to deal with it.

Bananas do well on a variety of soil types and each of the several commercial varieties has its own niche in the district. Grower preferences are dictated to some extent by aspect and altitude. The two most widely grown varieties are Mons Marie and the very similar,

if not identical, Williams Hybrid, both of which are semi-tall types capable of producing good quality fruit at higher altitudes than the dwarf Cavendish. The latter was formerly the main type cultivated and it is still an important commercial variety, although perhaps less tolerant of marginal soil and climatic conditions than some others. The Lady Finger is grown extensively on the better drained alluvial and heavy black clay loams near the coast in the northern part of the district. Owing to the incidence of Panama disease in this variety, growers show a tendency to make new plantings on slopes which would normally be assigned to other types.

The area of virgin land suitable for the crop is limited and the stability of the banana industry will depend on the ability of growers to prolong the life of the plantation or alternatively to recondition old banana land for replanting. Both present problems of soil management.

Plate 106.
HARVESTING PASSION FRUIT AT MUDGEERABA.

Passion Fruit.

Passion fruit grows well in some parts of the South Coast district, particularly on the plateau country, where cool weather brings the main crop to maturity at periods of the year when the principal markets are under-supplied with the fruit. Large-scale production occurs both on the rich, basaltic soils and on the coastal plains where good rains maintain a vigorous plant growth during most of the year. The seedlings are planted out during spring or autumn, preferably in well sheltered situations, and the vines are trained on wired trellises. The expense of establishing a crop is, therefore, high but this is compensated for by the high acreage returns. The initial crop appears within 12-15 months and the vines bear for at least four years if the plants are properly handled. The summer fruit crop matures rather late. Some of the passion vine diseases, particularly the virus disease woodiness and the fungous diseases brown spot and fusarium, may cause severe losses. Precautions are needed to keep these diseases in check and growers find it necessary to prune the vines and to spray regularly during the wetter months of the year.

Plate 107.
A PINEAPPLE PLANTATION AT MOUNT NATHAN.

Pineapples.

The area under pineapples is limited, but there is room for expansion and future prospects are bright. Cultural methods which are already standardised in the main producing areas further north are equally applicable in the South Coast. Formerly small areas were planted in and near bananas, but other land specially selected for its free draining properties and its ability to produce high quality fruit is being used in recent commercial plantings. The rough leaved pine is grown for the local fresh fruit market but the smooth leaved Cayenne, which is required by canneries and the southern fresh fruit markets, must inevitably be the basis of future production.

Other Fruits.

A variety of other fruits is grown on a small scale in the district. Strawberries of the Queensland variety Phenomenal thrive on well-drained soils, some of which are red clay loams and other light grey sands. The crop is planted each year between late February and early March and harvesting begins in July. Most of the fruit is grown under contract for processing.

The papaw is a useful supplementary crop for planting on sheltered slopes and could be grown more extensively than at present. If seed beds are established in November and seedlings transplanted during February and March, fruit is borne within arm's reach for at least two years and harvesting is relatively easy.

Plantations of the Macadamia or Queensland nut, which is indigenous to the coastal scrubs of southern Queensland, are now in commercial production. The common "ternifolia" type, carrying leaves with the prickly edges, is well suited to the district because of its adaptability to a wide range of soils and its early maturing habit.

Most of the trees are seedlings which vary in both growth and cropping habits. Until propagation problems have been solved and "worked" trees are available to growers, the industry can, however, make little real progress.

Vegetables.

Although vegetables are not grown extensively on the South Coast, the types in steady demand are supplied to local markets by specialist growers with irrigation facilities. Their produce, together with that marketed from speculative plantings on non-irrigated farms, must be supplemented from metropolitan districts during those periods of the year when there is an influx of visitors to the coastal resorts.

Tomatoes are often planted on the warmer slopes during the winter and spring and good yields are obtained from irrigated crops. There is ample room for an extension of the area under winter crop, which is apt to set badly in some important market gardening districts during cool weather. The selection of sheltered, warm slopes for the crop pays dividends. French beans are grown all the year round in some part or other of the district. They do very well both as a field crop and as an inter-row crop in young banana plantations. The main variety is Brown Beauty, a small-seeded, high-quality bean which throws its pods well clear of the foliage and is consequently relatively easy to pick. The bulk of the production is in the northern part of the district.

Production.

Production records for the district are shown in Table 2.

TABLE 2.

HORTICULTURAL PRODUCTION—SOUTH COAST DISTRICT (1949).

FRUIT.

—	Total.	Bearing.	Production.
Bananas	2,163 acres	1,802 acres	142,486 1¼-bus. cases
Pineapples	61 acres	41 acres	8,540 1⅛-bus. cases
Citrus	3,430 trees	895 trees	1,485 bus.
Nuts	2,784 trees	2,612 trees	14,871 lb.
Passion Fruit	23 acres	17 acres	4,295 ½-bus. cases
Mangoes	353 trees	199 trees	130 bus.
Papaws	9 acres	7 acres	1,197 bus.
Grapes	5 acres	4 acres	3,500 lb.
Strawberries	2 acres	..	2,595 lb.
Custard Apples	48 trees	28 trees	10 bus.

VEGETABLES.

—	Acreage.	Production.
Green Peas	89	3,406 bus.
Tomatoes	37	8,650 ½-bus. cases
French Beans	25	1,919 bus.
Cucumbers	23	1,977 bus.
Cabbages	15	3,518 dozen
Melons—		
Water	13	43 tons
Rock	1	3 tons
Cauliflowers	7	595 dozen
Marrows and Squashes	6	27 tons
Turnips	5	17 tons
Lettuce	4	1,406 bus.
Carrots	3	8½ tons

MARKETING.

With the exception of bananas, and to a lesser extent pineapples, most South Coast horticultural produce is marketed locally. Exacting standards in harvesting and packing are, therefore, unnecessary, even for highly perishable commodities. Little improvement can be expected so long as small areas are speculatively planted with small fruits or vegetables to supplement a farm income drawn mainly from agricultural crops. More efficient methods of handling fruit and vegetables would be essential if growers were wholly dependent on horticultural crops.

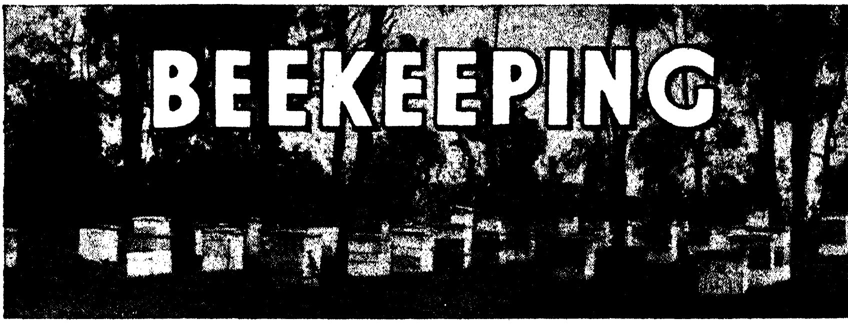
In the case of bananas and pines, a premium can normally be expected for quality fruit placed on the market. Approximately 72,000 cases of bananas were consigned to New South Wales in 1948-49. For this market, efficient grading and packing are necessary to reduce wastage in transit. Some of the fruit grown near the border is railed from New South Wales terminals but most is transhipped at Clapham Junction to interstate trains. Local practice depends on the proximity of the grower to the nearest railhead. Considerable quantities of bunch and cased bananas are also marketed in Brisbane. The Lady Finger variety is invariably marketed in the bunch; other varieties may also be marketed in the bunch if road transport is available between the farm and the nearest market.

THE FUTURE.

The horticultural future of the South Coast, particularly the southern end of the district, depends on the stability of the most important crop, bananas. Payable markets and a standard of land and crop management much higher than that generally practised at the present time are necessary. Exploitative methods of growing bananas belong to the past now that little good virgin land is available. The industry will almost certainly maintain its present level and it may even expand to some extent. A group of efficient banana growers have weathered the sharp ups and downs of the industry during the past 30 years and their production returns show what can be done when the grower understands both his crop and his soil. The future depends very largely on their influence among new growers entering the industry.

The area under pineapples will expand if present price levels are maintained. One disability with this and some other crops is the distance between adjacent farms, which is such that growers have few opportunities to exchange views on their common problems. These contacts do much to improve production methods.

The northern end of the district is probably less subject to the speculative production of small crops than the southern end. Its geographical position, too, may induce a trend to vegetable production for the metropolitan market in the not too distant future, at least in areas where the soil is fertile and irrigation water is available to ensure continuity of production.



Hints on Making Hives.

C. R. ROFF, Apiaries Inspector.

IN Queensland many beekeepers, both commercial and non-commercial, make their own hives. Due to the scarcity and increased cost of beekeeping equipment many others intend doing so and the following hints should be of interest.

When constructing a hive, the first essential is to decide the size and type. The Standard Langstroth ten-frame hive is the one most generally used in Queensland and home-made hives should conform to this general pattern. By having uniform equipment the parts are interchangeable from hive to hive and manipulation of the colonies is comparatively simple. An apiary composed of standard equipment will always sell at a better price than one made up of assorted or unusual sizes.

As the finished hive must be solidly built and able to withstand rough usage, the timber used should be seasoned softwood of good quality. The corners, which must remain square, are the weak parts of the hive and should be rabbeted and then nailed on both faces (Plate 108). Cement-coated nails should be used to prevent slipping, warping, and distortion. Before assembly, rabbeted surfaces should receive a good coat of oil paint.

The hive consists of a bottomboard, hive cover and hivebody or super containing ten movable frames. The component parts are not fastened together but are superimposed movable units (Plate 108).

The bottomboard or floor is 22 inches by 16 inches by $\frac{7}{8}$ inch thick. If an alighting board is not required the length should be reduced to 20 inches. On the upper surface, the edges should be raised on the two sides and the back end by nailing slats $\frac{7}{8}$ inch wide by $\frac{1}{4}$ inch thick. To prevent warping, two cleats 16 inches by 2 inches by $\frac{7}{8}$ inch thick should be attached across the under side of the bottomboard.

The top cover is designed to protect the hive from weather. A flush-fitting flat wooden cover, cleated on the upper side at the ends and across the centre, is the most convenient. The dimensions are 20 inches by 16 inches by $\frac{7}{8}$ inch thick. The cleats should be 16 inches by 2 inches by $\frac{7}{8}$ inch thick.

The hivebody or super is simply a bottomless wooden box which rests on the raised edges of the bottomboard. The standard dimensions of a hivebody or super made from $\frac{7}{8}$ inch timber are:—

Outside: 20 inches by 16 inches by $9\frac{1}{2}$ inches deep.

Inside: $18\frac{1}{4}$ inches by $14\frac{1}{4}$ inches by $9\frac{1}{2}$ inches deep.

If timber other than $\frac{7}{8}$ inch thick is used then all outside measurements of the hivebody, bottomboard and top cover will need to be adjusted. The inside dimensions as shown are essential for the correct fitting of the frames.

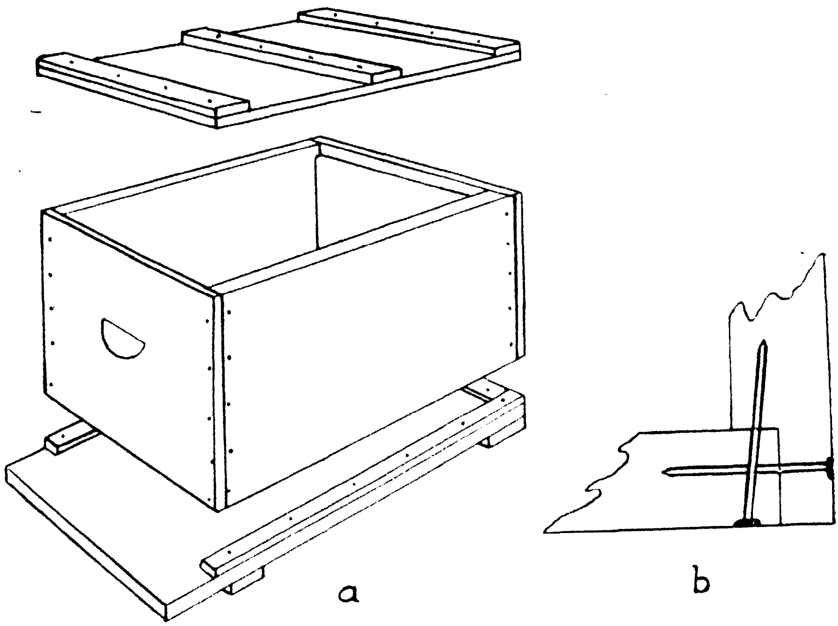


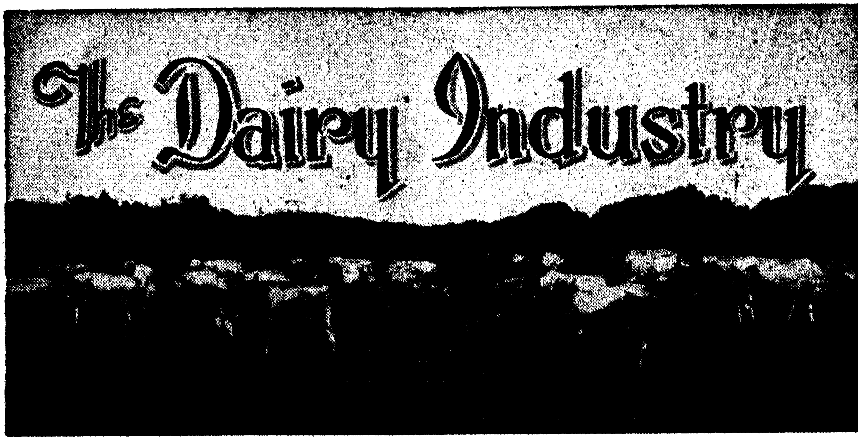
Plate 108.

DIAGRAM OF HIVE.—(*a*) Bottomboard, hivebody, and top cover; (*b*) corner of hive illustrating rabbeting and method of nailing.

The rabbets for cornering the hivebody should be cut into the end boards and should be $\frac{7}{8}$ inch wide by 7/16 inch deep, to receive the ends of the sides. The length of the side timber will be 20 inches less the depth of the two 7/16 inch rabbets, that is, $19\frac{1}{8}$ inches. Before the hivebody is assembled a rabbet, 7/16 inch wide by $\frac{1}{2}$ inch deep, should be cut into the inner top edge of each end board for supporting the frames. If metal rabbets are to be fitted then the timber rabbet should be $\frac{3}{4}$ inch deep instead of $\frac{1}{2}$ inch. A shallow slot or finger-grip should be cut or chiselled into the face of each end board, slightly above centre.

After the hive has been completed two or three coats of paint should be applied externally, the sawn edges receiving particular attention. The paint weatherproofs the hive, which, if repainted about every two or three years, will last indefinitely. Furthermore, hive temperatures are lower if white or very light-coloured paints are used.

Home-made frames are not recommended as the factory machined frames are accurately constructed and usually cheaper. Self-spacing frames are the most useful.



The Control of Mites at Cheese Factories and Cold Stores.

L. E. NICHOLS (Assistant Director and Senior Dairy Technologist, Division of Dairying) and J. A. WEDDELL (Assistant Senior Entomologist, Science Branch).

WITH the extension of the storage period of cheddar cheese in Queensland during the war years, due to irregularity of overseas shipments and the tendency to market a more mature cheese locally, mite infestation assumed considerable importance in factory holding rooms, in cold stores, and even in ships' holds.

In the past, manufacturers have tried to control mites without tainting the cheese, using ammonia, sulphur dioxide and formalin, but with only limited success. Following the reported successful experimental use of dichloroethyl-ether against cheese mites in New Zealand, the Department of Agriculture and Stock co-operated with a cheese manufacturing association and cold store owners in testing this material under commercial conditions in Queensland.

FACTORY TRIALS.

Two holding rooms containing waxed and unwaxed cheese were treated with dichloroethyl-ether. The cheeses were stored flat on wooden shelves and reasonably well spaced to permit of free circulation of the fumigant.

An atomising spray trigger gun with adjustable fine spray nozzle, known as an Engine Cleaning Gun, was fitted to the factory's compressed air system by means of 90 ft. of $\frac{3}{8}$ in. diameter pressure-tubing. A regulating valve and pressure gauge were attached to the end of the compressed air line, yielding 70 to 75 lb. per square inch pressure. Army gas masks No. 4 III, 1940 and 1941 models, fitted with $\frac{3}{4}$ in. diameter 5-ply steam rubber hose, which was later replaced by the standard cannisters, were worn by the operatives. The dosages were calculated on the basis of 1 lb. of dichloroethyl-ether per 1,000 cubic ft. of room space.

The atomised spray was so directed that all cheeses as well as empty shelves were enveloped in the spray mist. As far as possible marked wetting of cheese surfaces with the fumigant was avoided. Equipment used in the treatment is illustrated in Plate 109.

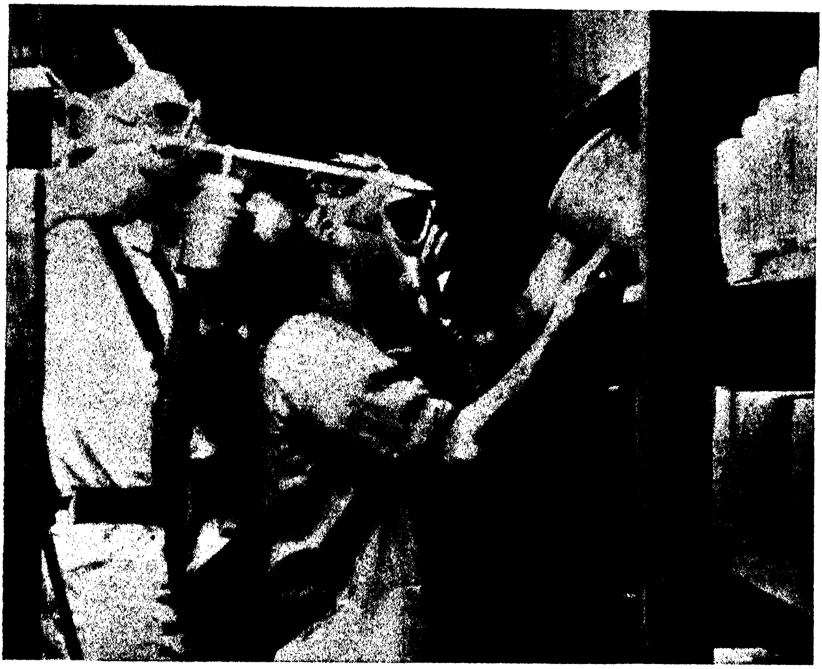


Plate 109.
EQUIPMENT USED IN HOLDING ROOM TRIALS.

In both cheese holding rooms subjected to treatment at the factory, heavy mite infestations occurred on the floors, shelving and the cheese. Loaf and medium sized cheese, including waxed and unwaxed, were stored in each room. The rooms were immediately sealed after treatment to prevent leakage of the fumigant and kept closed for a period varying from 24 to 48 hours before being opened and aired.

After airing, the cheese was transferred to treated shelves and turned so that the previously untreated surfaces were now exposed; a second dose at the rate of 1 lb. per 1,000 cu. ft, was applied and the rooms securely sealed for a further 48 hours. Some waxed and unwaxed cheese in the untreated rooms were conspicuously marked for future observation.

Because of the possible significance in the trade, and particularly for export purposes, various tests in crate treatment were made. For this purpose cheeses were stored in a third holding room that was heavily infested with mites and the various treatments included all combinations of waxed and unwaxed, treated and untreated cheeses, packed in treated and untreated crates. Observations on these cheeses were made over a period of two months.

Results.

(*a*) *Effect on Mite.*—Mite residues examined after the first treatment of the holding rooms showed a complete "kill" at all stages of the life cycle where directly exposed to the effects of the fumigant. However, there appeared to be no effect on the mite population under

the cheese, whether resting on the shelves or on other cheese or in cracked cheese. The surviving mite population, except in the cracked cheese, was, however, controlled by the second application.

(*b*) *Period of Immunity.*—Examination of the experimental cheese, after two months in the treated holding rooms, failed to reveal any live mites. However, continued observation indicated that a follow-up treatment was needed about three months after the first treatment.

With regard to the cheeses held in the infested holding room, those which had not been treated at all were noticeably infested, but where either the cheese or the crates or both had been treated with dichloroethyl-ether any mite infestation was of only a mild or localised nature. It was noted that untreated cheese was afforded reasonable protection simply by packing in a treated crate.

(*c*) *Effect on Cheese Flavour.*—Immediately after the first treatment, examination of plugs from waxed and unwaxed cheese showed no evidence of taint from the fumigant. The rind, however, of both waxed and unwaxed cheese had a distinct smell of dichloroethyl-ether, but this gradually diminished in intensity and after about three weeks could not be detected with any certainty.

COLD STORE TRIALS.

The success of the treatment with crated cheese suggested an extension of the trials with dichloroethyl-ether to the cold stores, where mites presented a problem in crated cheese for export. Methods of application that were tried included heat vaporisation of the fumigant buffered against explosion with carbon dioxide, spraying from a fixed spray line, and spraying from a hand atomiser.

The use of dichloroethyl-ether as a vapour was not persisted with owing to certain technical difficulties, including condensation in the specially arranged piping system. The fixed spray system did not favour uniform distribution of the fumigant due to the pressure gradient in the line, although in this case a large tonnage of cheese was treated with satisfactory results. It was therefore evident that the air-circulatory system had aided in the distribution. Finally, however, liquid application with a hand atomiser comparable to that in use at the factory was adopted.

Equipment and Method.

An engine spray gun with an adjustable spray nozzle and a one-quart capacity cannister was attached by means of 60 feet of $\frac{3}{8}$-inch diameter pressure tubing to a mobile compressed air tank, filled by an electric air compressor. A pressure gauge and a regulating valve operating at 80 lb. per square inch were fitted. The general arrangement of this equipment is illustrated in Plate 110. All chamber outlets were carefully checked and sealed against possible gas leakage where considered necessary. Trays containing live mites were exposed in various parts of the cold store and at varying heights, some being protected and others unprotected from possible direct spray. This method of checking the effect of the fumigant on the mites had been used also for the fixed spray system.

The fumigant was applied as an atomised spray at the rate of 1 lb. per 1,000 cu. ft. as uniformly as possible over crates, walls and towards the ceiling. The cold store was then securely sealed for 48 hours.

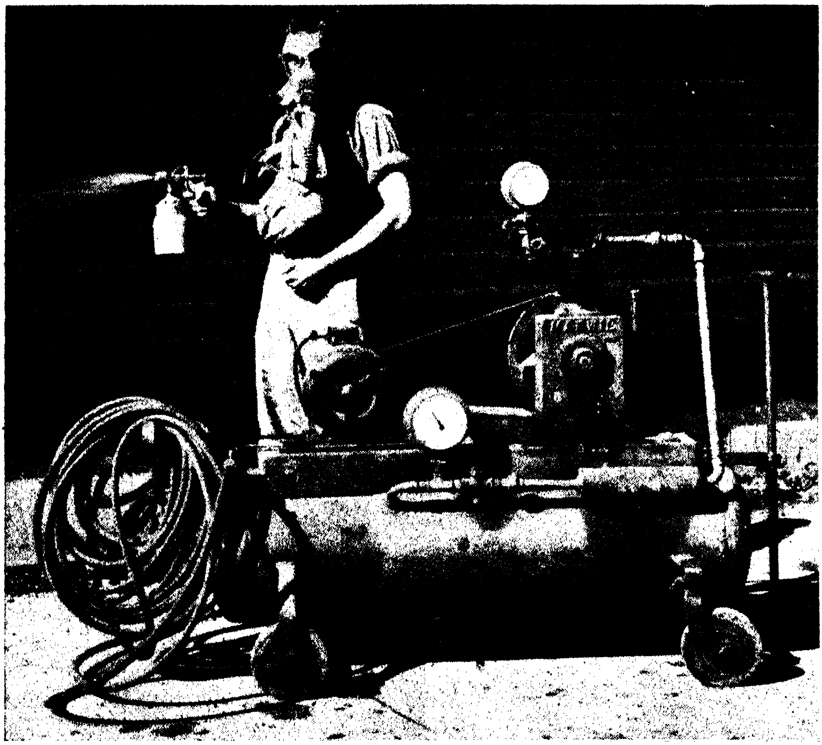


Plate 110.
EQUIPMENT USED IN COLD STORE TRIALS.

Results.

A complete kill of mites was obtained from the treatment, as was shown by examination of the sample trays and also of certain infested cheeses that had been earlier distributed in the chamber for test purposes. Both Commonwealth and State Graders confirmed that neither the cheese flavour nor the rind were affected by the treatment.

Treated Cheese Consigned to the United Kingdom.

The contents of the cold stores which had been treated were subsequently consigned in the one shipment to the United Kingdom. A qualified Commonwealth Officer examined this consignment in London and he reported a complete absence of mite infestation, and no effect whatsoever on the flavour or the rind of the cheese.

COSTS OF DICHLOROETHYL-ETHER TREATMENT AND OF SUITABLE ATOMISING EQUIPMENT.

The cost of the fumigant for treating 13,000 cu. ft. of room space at the cheese factory was £4 10s. 9d. As the weight of cheese treated was 23,000 lb., the cost averaged 0.04d. per lb. Dichloroethyl-ether is available locally for approximately 2s. per pound. The improvised equipment used at the cheese factory involved no special expenditure.

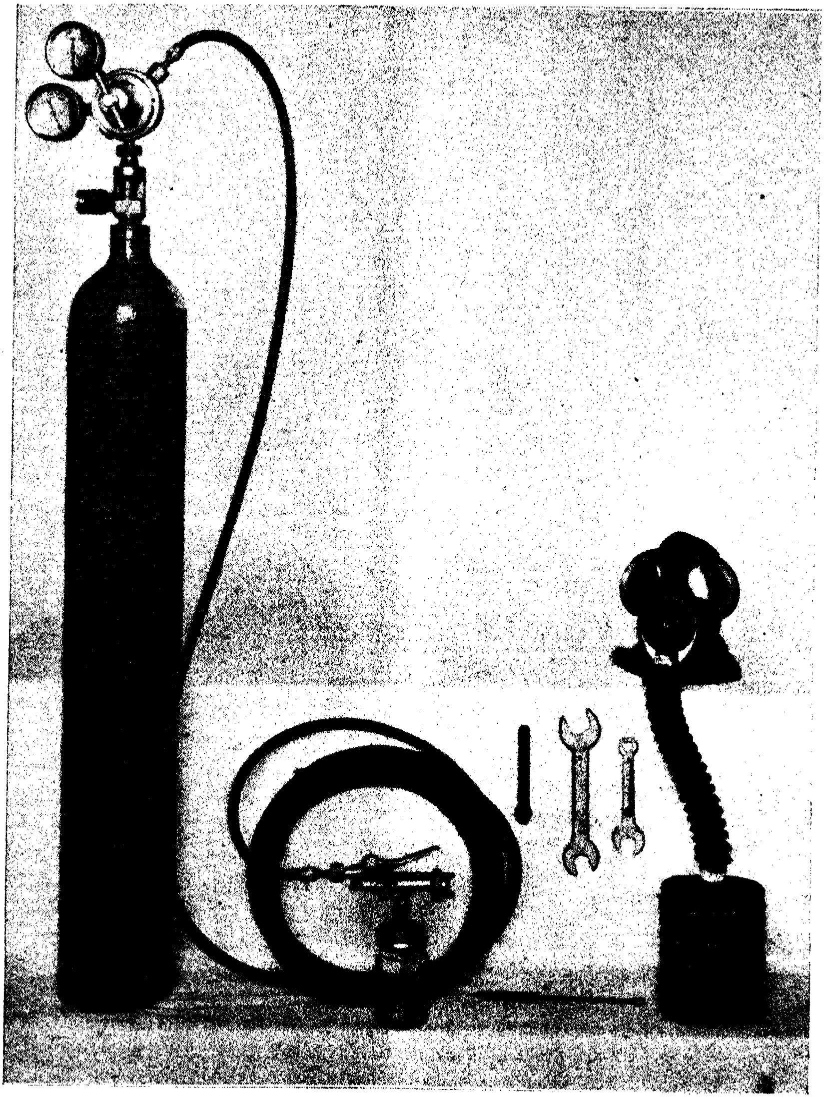


Plate 111.
PORTABLE OUTFIT FOR "ATOMISATION."

A complete portable outfit, including pressure tubing, adjustable spray gun, container and spanners (Plate 111) is now available on the local market for £15 10s. For each treatment a cylinder of compressed air is obtainable for 5s., the cylinders being returnable. This outfit is particularly suitable for small cheese factories where compressed air may not be available.

At the cold store the export consignment was treated at a cost of £5 2s., or 0.0006d. per lb., for chemicals only, the portable spray outfit and mobile pump being part of the cold store equipment and was operated by ordinary factory labour.

Further large scale treatments carried out by the employees at six cheese factories and four cold stores have proved the "atomisation" method to be cheap, practicable, and effective in controlling cheese mites.

CONCLUSIONS AND RECOMMENDATIONS.

The results indicated that a reasonable degree of control of mite infestation was obtained in cheese holding rooms and cold stores. For continued control, however, periodical treatments at approximately 3-monthly intervals appear essential, these treatments to be applied in conjunction with a reasonable standard of hygiene.

It is therefore recommended that the following treatments be applied according to the particular circumstances.

(*a*) Where cheese rooms are or can be emptied they should be thoroughly swept and cleaned, especially the shelving, and then sprayed with dichloroethyl-ether at the rate of 1 lb. of the fumigant per 1,000 cu. ft. The spray should be applied uniformly to all surfaces. A treated room should be immediately closed for a period of 24 hours.

(*b*) Where mite-infested cheese is already stored the following points should receive attention:—

(i.) The cheese should be spaced so as to permit of free circulation of the fumigant mist.

(ii.) Stocks should be rearranged so as to empty sections of the shelving or room.

(iii.) Dichloroethyl-ether should be uniformly sprayed throughout the room at the rate of 1 lb. per 1,000 cu. ft. and the room kept closed for a period of 24 hours.

(iv.) Following the first treatment the cheese should be inverted on to the previously emptied shelving.

(v.) The treatment should be immediately repeated.

(*c*) Where chutes or conveyors are used in transferring cheese to or from the chamber these also should be swept and sprayed.

(*d*) Where cheese is to be stored for a considerable period, particularly if stocks are being changed from time to time, treatments (*b*) and (*c*) above should be repeated every three months.

The above recommendations must be combined with a high standard of curing room hygiene, in that cheese should be frequently turned, cracked or otherwise damaged cheese removed, and shelving should be kept free of fat or grease accumulations by removal and scalding if necessary. In addition, temperatures in cheese store rooms should not exceed 60 degrees F.

In emergency cases, if mite-infested cheese is to be stored in otherwise clean rooms and fumigation is not immediately possible, such cheese and the crates or other containers may be lightly but thoroughly sprayed with dichloroethyl-ether. Uncrated cheese may be lightly brushed with the fumigant if an atomiser is not available. It is desirable that operators applying dichlorethyl-ether should be supplied with respirators comparable with the standard army pattern.

Wool and its Growth.

G. R. MOULE, Director of Sheep Husbandry.

THE wool follicle is often described as a minute factory in which wool is made. Accordingly, particular interest centres around its functioning and structure. It is not often appreciated, however, that Merino sheep, in common with most other breeds, have two quite different types of follicles. The proportion of different types determines the type of fleece any particular sheep will grow.

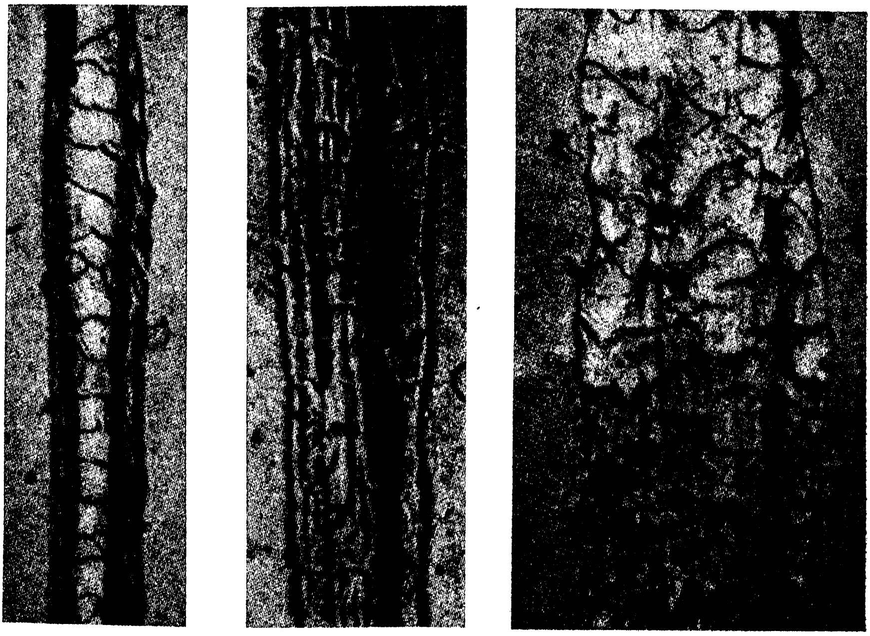


Plate 112.

MICROPHOTOGRAPHS OF FIBRES FROM VARIOUS BREEDS OF SHEEP.—*Left to right*: Tasmanian Merino, Southdown, Romney Marsh. (*After A. F. Barker.*)

Apart from the arrangement of the follicles, however, there are a number of factors which influence wool growth. These include such widely differing things as the way in which the sheep is fed, the weather conditions and the health of the animal. These are outlined in this article.

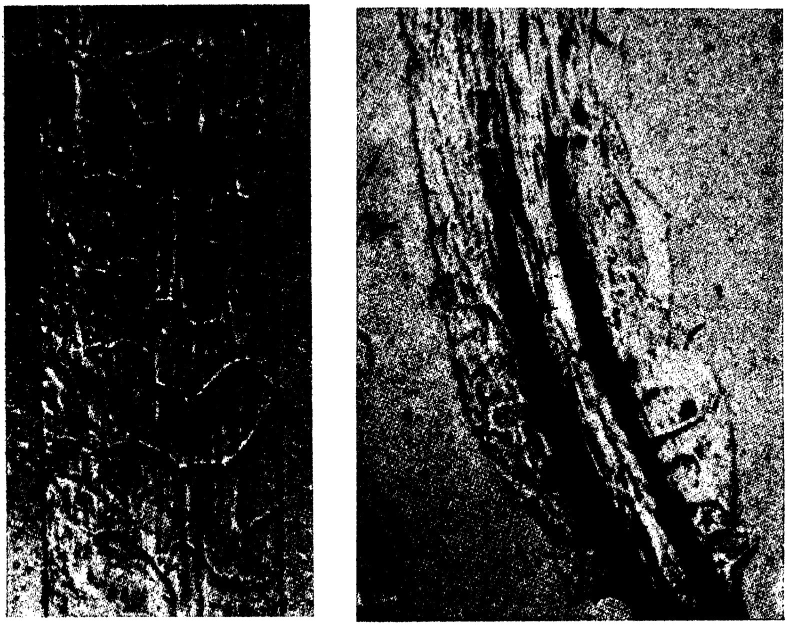


Plate 113.
Cotswold Wool (left) and Mohair (right) Fibres Compared.
(After A. F. Barker.)

Wool and Kemp Fibres.

There are many breeds of sheep and they are kept for such widely divergent purposes as wool-growing, dairy production and mutton raising. Naturally the appearance of the different breeds varies a good deal with the particular function the animals fulfil, but all sheep do not grow wool. Some breeds, such as the fat-tailed sheep indigenous to Africa, are covered by comparatively short, coarse fibres which resemble hair. Others, such as the Australian Merino and Corriedales, are noted for the wool they produce (Plates 112 and 113).

Rather an interesting story is told about some pigs which were left on an island in the Antarctic, probably in the early part of this century. When the weather station was established at Heard Island, the descendants of these animals were discovered. Instead of being covered with their usual coarse bristles they had grown a thick undercoat of soft fur which protected them from the cold.

In the development of the woolly coat of the Merino sheep similar physiological happenings probably occurred, although the animals were not subjected to such extreme variations in temperature. Wool is really the highly developed undercoat and even in a Merino fleece there are two kinds of fibres, referred to as primary and secondary fibres. The soft wool fibres are the secondary fibres, and the stiffer coarser kemps are the primaries.

The Structure and Development of the Wool Follicle.

The structure of a typical primary follicle and a secondary or wool growing follicle is shown in Plate 114. The most important differences lie in the absence of the arrector muscle and the sweat gland from the secondary follicle.

Despite their similarity in structure, there are important differences in the development of the follicles and it is worthwhile considering these in detail. After the ram's sperm has fertilised the ovum produced by the ewe rapid development takes place. It is not long before the developing lamb is covered with a layer of flat cells which do not present any very obvious developmental characteristics. Somewhere about the 30th to 45th day after conception these cells start to arrange themselves in definite order and gradually follicles are formed. These changes usually commence on the poll and the face and they spread down the midline of the back towards the tail. From the midline of the back they spread towards the belly and down the limbs. The average duration of this phase is about 15 days, so that by the time the foetus is 60 days old its skin covering is marked by quite a large number of rudimentary single follicles.

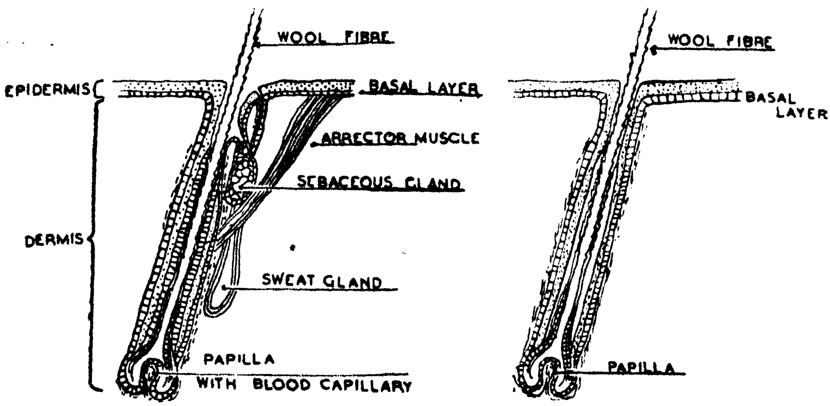


Plate 114.
STRUCTURE OF PRIMARY WOOL FOLLICLE (LEFT) AND SECONDARY WOOL FOLLICLE (RIGHT).

During the next stage additional small follicles develop on either side of the more advanced primaries. As this stage proceeds the follicles become arranged in groups of three and accordingly it is referred to as the trio stage and must be regarded as the real foundation of the follicle group. The arrangement of the follicles becomes progressively more orderly as they develop in short discontinuous parallel rows. This stage may commence about the 55th day after conception, though more usually it does not begin until the 75th day. As its duration is about 15 days it is complete by the 90th day.

During the next stage of development, which is referred to as the post-trio period, the secondary follicles make their first appearance between the members of the trio group. At this stage a race develops between the rate at which the skin grows and the rate at which the follicles and the connective tissue under the skin are laid down. Should the skin grow more quickly than the connective tissue beneath, the skin is thrown into a number of folds—that is, a "developed" lamb

is born. This final stage of development is the most important from the point of view of the density in terms of fibre populations per square inch. The density of the follicle population is greatest at about the 120th day after conception. Should the skin grow rapidly enough after that time to form itself into folds, the number of fibres per square inch of skin area decreases. If on the other hand the skin does not grow very extensively during the last 30 days before the lamb's birth, it fits the young body closely and there is little evidence of folds. In this case the wool follicles remain near their maximum density per unit of skin area.

At birth, then, the lamb has all the essential features for the arrangement of its adult fleece. Some secondary follicles may be added, but this soon stops. During the early growing period there may be expansion in the area occupied by the trio group of primary fibres and their associated secondary follicles due to an increase in the amount of skin tissue between them. There is a rapid emergence of the late secondary fibres. Finally there is successive shedding of the fibres from the primary follicles and this takes place approximately in the order of their establishment. While this shedding is a continuous process there is variation in the rate and the shed fibres are often replaced by stiff coarse "kemps." The development is shown diagrammatically in Plate 115.

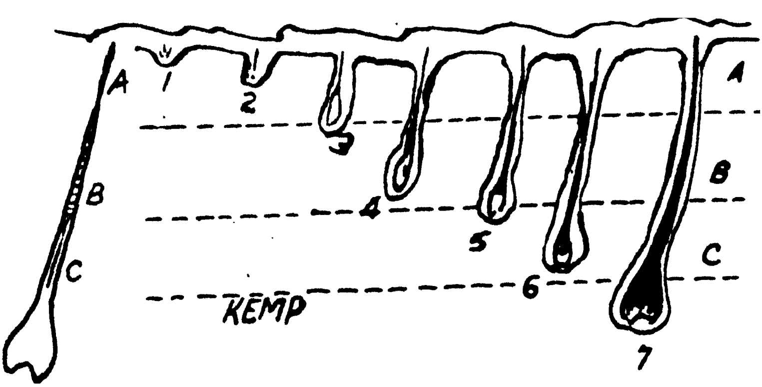


Plate 115.

Diagram Illustrating the Change in the Birth Coat Fibre from Merino to Kemp.—A, Merino Zone; B, Down Zone; C, Medullated Zone.

In view of these happenings the density of the fleece, in terms of the number of fibres per square inch, is only a relative term and it often decreases as the size of the animal's skin increases. Probably the most important factor is the relative proportion of the primary to secondary follicles, that is, the proportion of the total follicles which grow kemps and the proportion which grow wool fibres (Plates 116 and 117). It has been suggested that the relationship might be expressed by the formula P:(P+S), where P is the total number of primary follicles per square inch and S the number of secondary follicles. For Merinos this ratio may vary between 1:15 and 1:28. For British breeds it is somewhat lower.

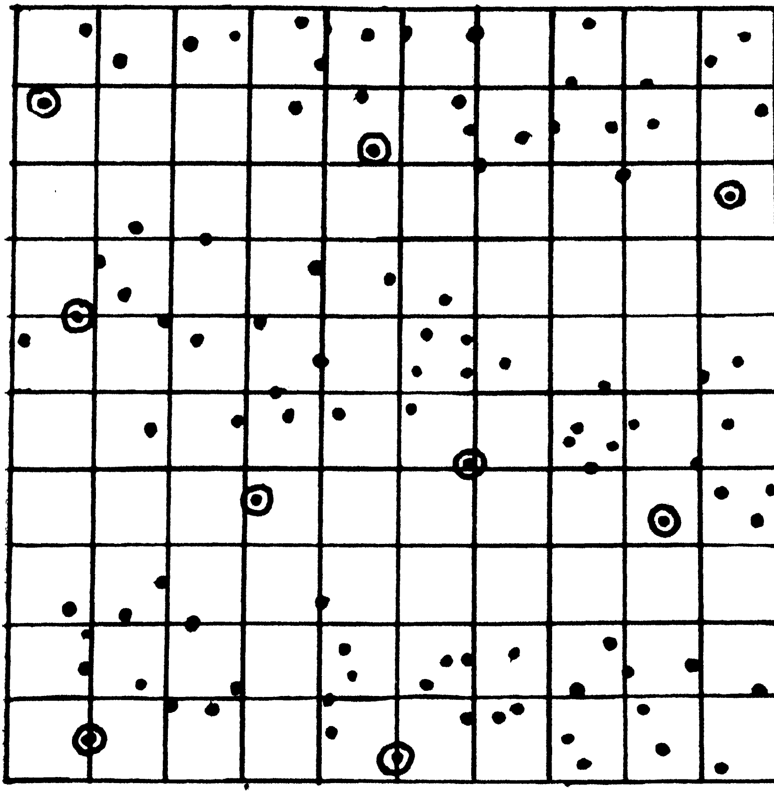


Plate 116.

CHART SHOWING THE POSITION AND APPROXIMATE RELATIVE SIZES OF WOOL FIBRES OF A SMALL AREA OF A MERINO'S SKIN.—Fibres growing from a primary follicle are ringed. In this section there are 9 primaries in a total of 103 follicles, a ratio of 1 : 11.45. (*After H. B. Carter.*)

Observations on a group of lambs at marking time will reveal the difference in the ratio of primary and secondary follicles which may exist in any flock. The lambs with hairy birth coats may have a high ratio of primary follicles or the emergence of the secondary fibres may have been delayed. On the other hand, the lamb with the soft woolly birth coat has a high proportion of functioning secondary follicles.

The definite gradation in the order in which these developmental changes take place leads to a fairly well known variation in the fleece of some sheep. While the breeder aims at keeping the covering of his animals as uniform as possible all over, weaknesses can often be noticed on the belly, the points and the breech. Poor covering of the belly and points suggests that a high proportion of secondary follicles have not developed in these parts. Hairiness of the breech suggests a higher proportion of primary follicles than is desirable.

Factors Influencing Wool Growth.

Many factors influence the growth of wool. They include those which act from within the sheep and those which are due to the external environment.

Plate 117.

SHOWING RELATIVE POSITIONS OF PRIMARY AND SECONDARY FOLLICLES IN A MERINO.—1. Minor or transverse connective tissue trabecula. 2. Wool follicle and fibre. 3. Sudoriferous gland duct. 4. Lobe of sebaceous gland. 5. M. arrector pili. 6. Major or longitudinal connective tissue trabecula.

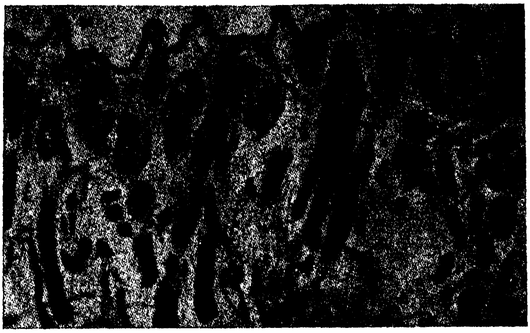
A. *Primary follicle and accessory structures* (bilobar sebaceous gland, sudoriferous gland, and m. arrector pili).

B. *Secondary follicles.* Portion of a cluster occupying a characteristic position between two primary follicles.

(*After H. B. Carter.*)

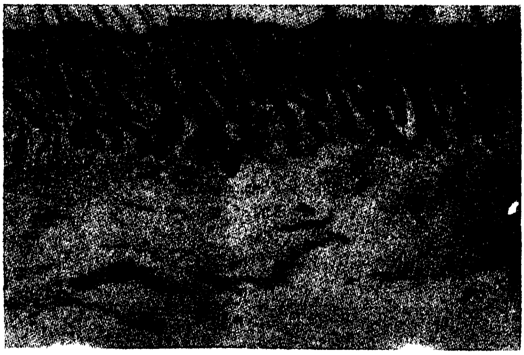
Of those inherent in the sheep, breed, age and sex must be considered as well as the way in which the animal is fed and the efficiency with which it converts food to wool. Comparatively little need be said about the influence of breed. The wool grown by the British breeds is markedly different from Merino wool in staple length, crimp formation, colour, fibre diameter and the arrangement of the folds on the outer cuticle sheath (Plate 118). This is due to inherent differences in the arrangement and proportion of primary and secondary follicles, in the size of the lumen through which the wool is secreted and in the rate at which the wool is produced. These breed differences are obvious, but there are also strain differences within breeds. For instance, there are the fine woolled Tasmanian Merinos, the medium to strong woolled Peppins and the strong woolled South Australian Merinos, within the Merino population in this country. Even within strains there are differences between families and between individuals.

The age of the sheep affects wool growth by influencing the number of wool-growing follicles which are functioning. There is some evidence to suggest that some of the secondary follicles cease to function as the sheep gets older, although it is not clear if this is due directly to age or to other factors such as an impaired capacity of the sheep to handle its food because of worn teeth.



LUSTRE.

DOWN.



MERINO.

Plate 118.

SKIN SECTIONS OF LUSTRE (LINCOLN TYPE), DOWNS AND MERINO.
(After A. F. Barker.)

After rain there is usually a quick flush growth which is followed by the setting of seed. Generally speaking, the available protein in the plant is concentrated in the seed, and unless a large number of these are available to the sheep, which is the case when they are living on clover burr, their diet may be protein deficient. A low protein content is characteristic of some of the pastures in western Queensland. This is

particularly the case in the Mitchell grass downs of the central-west and north-west, where summer rainfall predominates. Acute protein deficiency is seen in drought time when there is an overall shortage of food, but there is an imperceptible protein deficiency in the spring of quite good years. In the southern part of the State, winter and early spring rains are more reliable and there are a large number of herbage plants which ensure a more even supply of protein in the diet.

Of the environmental factors influencing the growth of wool, nutrition is of paramount importance. Wool is largely composed of protein and an adequate and even supply in the diet is a necessary precursor to normal wool growth. Most feeding standards suggest that adult sheep require 1·75 lb. of digestible crude protein per week to meet the normal requirements for maintenance and for wool growth. From results obtained in hand feeding of stud Merino sheep, it appears that this may not be adequate to allow for maximum wool production. Probably 2·25 lb. of digestible crude protein is nearer to the actual requirements.

The building blocks of which proteins are made are known as amino acids and some of these are essential for the growth of wool. Two of the most important amino acids are cystine and methionine and there are quite wide variations in the quantity different plants contain. The reputation which linseed meal has won as a sheep feed is partly due to its amino acid content.

During times of protein shortage the sheep decreases the amount of wool keratin which is secreted from the follicles. There are three ways in which this can be done:

(1) It may decrease the rate of wool growth; this leads to a decrease in staple length.

(2) It may decrease the size of the aperture of each follicle; this leads to a decrease in fibre diameter.

(3) It may decrease the number of follicles which are functioning; this leads to a decrease in density of the fleece.

Probably the sheep uses a combination of these and does not rely on any particular one. In times of acute stress, such as occurs during sickness, flystrike or a very bad drought, the sheep usually decreases the diameter of its fibres fairly rapidly and this may lead to a "break" in the wool.

There may also be a decrease in density as the sheep grows older, as it is probable that some secondary follicles cease to function in some aged animals. This may be an explanation of the so-called "doggy" wool in some old sheep.

It is now well known that copper is an essential constituent in the diet of sheep. Besides affecting the rate of blood production it is essential to the formation of a normal crimp. Usually the soft pliable substances from which wool is formed are converted into keratin in the lower part of the follicle. When there is inadequate copper circulating in the blood the formation of wool keratin is delayed and is completed only just before the fibre emerges from the follicle. This leads to the formation of the abnormal wavy crimp so characteristic of copper deficiency (Plates 119 and 120).

Plate 119.

EFFECT OF COPPER DEFICIENCY ON WOOL.—*Left*, Crossbred wool, showing half of staple copper deficient. *Right*, Merino wool, showing last inch of staple copper deficient.

Plate 120.

EFFECT OF COPPER DEFICIENCY ON WOOL.—This sample taken from a black sheep shows how the wool became pale and lost its crimp when the sheep was put on a diet deficient in copper.

MARKETING

"The Pest Destroyers Act of 1939"—Registrations.

A PEST destroyer is any prepared or natural substance sold as a fungicide, insecticide, vermin destroyer, weed destroyer, lure or steriliser or cleanser.

A fungicide is any substance used or intended to be used for the purpose of destroying or preventing the attacks of fungi or other parasitic plants or bacteria affecting or which may affect seeds, fruit, vegetables, plants, or other produce of the soil or any stock food, or any substance declared by regulation to be a fungicide.

An insecticide is any substance used or intended to be used for the purpose of destroying insects or other pests which infest or attack seeds, fruit, vegetables, plants, or other produce of the soil, or any stock food or which infest or attack animals, or for preventing such insects or pests from infesting or attacking the same, or any substance declared by regulation to be an insecticide.

A vermin destroyer is any substance used or intended to be used for the purpose of destroying rabbits, rodents, dingoes, foxes, or other noxious animals or noxious birds, or any substance declared by regulation to be a vermin destroyer.

A weed destroyer is any substance used or intended to be used for the purpose of destroying or preventing the spread of weeds or noxious plants, or any substance declared by regulation to be a weed destroyer.

A lure is any material used or intended to be used to lure or attract any insect or pest or vermin for purposes of destruction.

A steriliser or cleanser is any substance used or intended to be used, or advocated for use, for the purpose of sterilising or cleansing dairy utensils, equipment, or machinery, or used or intended to be used for any other sterilising or cleansing purpose relating to agriculture or stock: Provided that soaps and soap powders that do not contain any constituents useful or claimed to be useful for sterilising shall not be included.

Before any pest destroyer is placed upon the Queensland market, an application for registration must be made by the Queensland primary dealer and such application renewed every three years, i.e.,

1952, 1955, 1958, &c., during the month of January. Registration fees are payable annually. No sales should take place until registration has been effected.

Application for registration or renewal thereof involves the forwarding of a statutory declaration, setting out the formula of the preparation, accompanied by a specimen label and sample, and the necessary fees, i.e., 5s. for each preparation, with a maximum of £1 per year. These applications are duly examined with respect to the Act's requirements and placed before the Pest Destroyers Board—consisting of the Agricultural Chemist, an entomologist (plants), an entomologist (veterinary), a pathologist (plants), a pathologist (veterinary), and the Registrar.

The formulae, claims and statements made are considered, and, if approved, the pest destroyer, upon completion of all the Act's requirements, is duly registered.

All labels are required to set out the following:—

(*a*) The distinctive name of the pest destroyer;

(*b*)—

(i.) A statement of the names and respective percentages of the active constituents with the forms in which they occur or substances from which they are derived;

(ii.) A statement of any prescribed particulars relative to standard, quality, or rate of dilution with respect to the pest destroyer concerned;

(*c*) The net weight or volume content of the package;

(*d*) All directions for use of the pest destroyer;

(*e*) The name and address of the primary dealer or manufacturer;

(*f*) The word POISON when required.

The word "POISON" should be in red letters on a white ground, in larger and heavier type than any other letter on the label; and no other word shall appear on the same line. No other letter on the label shall be in a red colour.

Farmers and other buyers would be well advised *never to accept delivery* of any pest destroyer unless it has affixed to the package a plainly printed label setting out the required information.

In the absence of a label it is obvious that the buyer should at once communicate with the Standards Branch, Department of Agriculture and Stock, William Street, Brisbane.

The Pest Destroyers Act provides that no person shall affix any label and/or brand to or issue or use with or in connection with any pest destroyer or the sale thereof, any invoice, directions for use, or any printed, typed or written matter, and/or advertisement which contains—

(*a*) Any statement which is false or misleading in any particular concerning the substances therein referred to;

(*b*) Any comment or reference to or explanation of any statement required by this Act which directly or by implication contradicts, qualifies, or modifies any particular required by this Act to be shown thereon;

(*c*) Any statement, comment, or reference which expresses, suggests, or implies, or may be construed to express, suggest, or imply, that the pest destroyer has been the subject of a trial or trials or has been used or is recommended by the Department of Agriculture and Stock and which could in any way be used for purposes of furthering the sale of such pest destroyer;

(*d*) Any words or expression signifying, suggesting, or implying that the pest destroyer is approved or guaranteed under the provisions of this Act or any other Queensland law.

The pest destroyers as set out in the following list are those that have been registered up to 2nd December, 1949, for the three-year period January, 1949, to December, 1951, under the above Act. These and any published in subsequent lists are the only pest destroyers that should be offered for sale or requested by prospective purchasers.

It should be noted that the sale of any unregistered pest destroyer would render the seller liable to a penalty not exceeding £50.

Further particulars may be obtained from the Standards Branch, Department of Agriculture and Stock, William Street, Brisbane.

LIST OF PEST DESTROYERS REGISTERED IN QUEENSLAND UNDER "THE PEST DESTROYERS ACT OF 1939."

For the Period Commencing January, 1949, as at 2nd December, 1949.

Name of Pest Destroyer.		Active Constituents as Declared by Seller.	Queensland Wholesale Dealer.
		ARSENATE OF LEAD.	
POWDER.	Per cent.		
A.C.F. Arsenate of Lead Powder	31·0	Arsenic Pentoxide (As_2O_5) as Lead Arsenate	A.C.F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
Lane's Arsenate of Lead	31·0	Arsenic Pentoxide (As_2O_5)	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Pinnacle Brand Arsenate of Lead	30·5	Arsenic Pentoxide (As_2O_5) as Lead Arsenate	Cloudust Spray Manufacturers, Montague road, South Brisbane
Waratah Brand Arsenate of Lead	30·5	Arsenic Pentoxide (As_2O_5) as Lead Arsenate	Committee of Direction of Fruit Marketing, Turbot street, Brisbane
"Vallo" Arsenate of Lead Powder	32·0	Arsenic Pentoxide (As_2O_5)	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
Berger's Mercury Brand Arsenate of Lead Powder	31·0	Arsenic Pentoxide (As_2O_5) as Lead Arsenate	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
Cooper's Arsenette	31·0	Arsenic Pentoxide (As_2O_5)	Queensland Fruitgrowers' Co-op. Soc. Ltd., Makerston street, Brisbane
PASTE.			
"Vallo" Arsenate of Lead Paste	32·0	Arsenic Pentoxide (As_2O_5) (on dry basis)	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
Berger's Mercury Brand Arsenate of Lead (Paste)	30·0	Arsenic Pentoxide (As_2O_5) (on dry basis)	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
		ARSENATES OF CALCIUM.	
"Vallo" Arsenate of Calcium	40·0	Arsenic Pentoxide (As_2O_5)	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
		ARSENATE OF SODA.	
Elliott's Tinbar	64·0	Arsenic Trioxide (As_2O_3)	Taylors Elliotts Pty. Ltd., 150–160 Charlotte street, Brisbane
		ARSENIC.	
Refined Arsenic	99·0	Arsenic Trioxide (As_2O_3)	G. Horsburgh & Co. Pty. Ltd., Kent street, Maryborough
"Vallo" White Arsenic	98·0	Arsenic Trioxide (As_2O_3)	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
Street's Pure Arsenic	98·0	Arsenic Trioxide (As_2O_3)	Wm. Street & Sons, 176 Ann street, Brisbane
		ARSENIC PENTOXIDE.	
"Vallo" Granulated Pentoxide Weed Killer	83·0	Arsenic Pentoxide (As_2O_5)	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
Elliott's Voskin	60·6	Arsenic (As_4) as Arsenic Pentoxide	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
		ARSENICAL WEED AND VERMIN DESTROYERS.	
Bickford's Ant Powder	35·0	Arsenic Trioxide (As_2O_3)	A. M. Bickford & Sons Ltd., Tank street, Brisbane
Nosco Liquid Weed Killer	36·0	Arsenic Trioxide (As_2O_3) as Sodium Arsenite	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Knoxit Liquid Weed Killer	54·0	Arsenic Trioxide (As_2O_3)	Cloudust Spray Manufacturers, Montague road, South Brisbane
C.O.D. Improved Weed Killer	40·0	Arsenic Trioxide (As_2O_3)	Committee of Direction of Fruit Marketing, Turbot street, Brisbane
Ex-L-Col Tree Killer	64·0	Arsenic Trioxide (As_2O_3)	Denham Bros. (R'ton) Pty. Ltd., East street, Rockhampton
Quickstroy Improved Weed Killer	40·0	Arsenic Trioxide (As_2O_3)	J. H. Eden & Co., 483 Lutwyche road, Lutwyche, Brisbane
Harton Weed Killer	64·0	Arsenic Trioxide (As_2O_3)	Goldsborough Mort & Co. Ltd., Eagle street, Brisbane
Graydust	30·0 50·0	Sodium Fluoride Arsenic Trioxide (As_2O_3)	Houghton & Byrne Pty. Ltd., 161 Queen street, Brisbane
Camelia Weed Killer	36·0	Arsenic Trioxide (As_2O_3)	International Traders, 228 Roma street, Brisbane
Arseen Liquid	86·4	Arsenic Trioxide (As_2O_3)	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
Mactaggart's Tree Killer	64·0	Arsenic Trioxide (As_2O_3)	Mactaggarts P.P. Co-op. Assn. Ltd., 70–2 Eagle street, Brisbane
Mactaggart's Weed, Scrub and Tree Killer	36·0	Arsenic Trioxide (As_2O_3)	Mactaggarts P.P. Co-op. Assn. Ltd., 70–2 Eagle street, Brisbane
P.C.D. Tree Killer	64·0	Arsenic Trioxide (As_2O_3)	Port Curtis Co-op. Dairy Assn. Ltd., O'Connell street, Gladstone
Cooper's Weedicide	56·0	Arsenic Trioxide (As_2O_3)	Queensland Fruitgrowers' Co-op. Soc. Ltd., Makerston street, Brisbane

Hart's Liquid Arsenic	[illegible]	Arsenic Trioxide (As_2O_3)	Queensland Pastoral Supplies Pty. Ltd., Bowen street, Brisbane
Killaweed (in two solutions)	80·0	Arsenic Trioxide (As_2O_3) (in one solution)	Queensland Pastoral Supplies Pty. Ltd., Bowen street, Brisbane
Street's Cure for Ants, etc.	5·5	Arsenic Trioxide (As_2O_3) as Sodium Arsenite	Wm. Street & Son, 176 Ann street, Brisbane
Street's Cure for Weeds, etc.	10·0	Arsenic Trioxide (As_2O_3) as Sodium Arsenite	Wm. Street & Son, 176 Ann street, Brisbane
Tropic Tree Killer	64·0	Arsenic Trioxide (As_2O_3)	Tropical Dip & Chemical Co., Cambridge street, Rockhampton
United Improved Weedtox	64·0	Arsenic Trioxide (As_2O_3)	United Chemicals Pty. Ltd., 91–7 Montague road, South Brisbane
United Liquid Tree Killer	64·0	Arsenic Trioxide (As_2O_3)	United Chemicals Pty. Ltd., 91–7 Montague road, South Brisbane

BENZENE HEXACHLORIDE PREPARATIONS.

Aeroflo CSG 7602 Dust	7·0	Copper (Cu) as Copper Oxychloride	Aeroflo Dusts & Sprays Pty., Redland Bay Road, Redland Bay
	60·0	Sulphur (S) as Powdered Sulphur	
	0·26	gamma isomer of Benzene Hexachloride	
Aeroflo G. 5 Dust	0·5	gamma isomer of Benzene Hexachloride	Aeroflo Dusts & Sprays Pty., Redland Bay Road, Redland Bay
F.D.L. BHC 10 % Dust	1·3	gamma isomer of Benzene Hexachloride	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
Gammawash	3·5	gamma isomer of Benzene Hexachloride	Grazcos Co-op. Ltd., 356 Queen street, Brisbane
Gammexane Industrial Dust No. 1	0·5	gamma isomer of Benzene Hexachloride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Gammexane 50 Dispersible Powder	6·5	gamma isomer of Benzene Hexachloride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Gammexane Liquid Concentrate LG. 140	10·0	gamma isomer of Benzene Hexachloride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Gammexane No. 7 Miscible Oil	7·0	gamma isomer of Benzene Hexachloride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Gammexane No. 10 Dust	1·3	gamma isomer of Benzene Hexachloride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Gammexane Smoke Generator No. 2	3·25	gamma isomer of Benzene Hexachloride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Gammexane Smoke Generator No. 12	3·25	gamma isomer of Benzene Hexachloride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Gammexane Smoke Generator No. 22	14·4	gamma isomer of Benzene Hexachloride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Cooper's Louse Powder	0·6	gamma isomer of Benzene Hexachloride	New Zealand Loan & Mercantile Agency. Co. Ltd., Eagle street, Brisbane
Gamma Di	1·3	gamma isomer of Benzene Hexachloride	Nightingale Supply Co. Ltd., 1078 Ann street, Brisbane
Cooper's Gamaturf	6·0	gamma isomer of Benzene Hexachloride	Qld. Fruitgrowers Co-op. Soc. Ltd., Makerston street, Brisbane
Plane Brand Gammacide No. 5 Dust	0·5	gamma isomer of Benzene Hexachloride	Qld. Fruitgrowers Co-op. Soc. Ltd., Makerston street, Brisbane
Rudust No. 13 10% BHC in Rock Phosphate	1·3	gamma isomer of Benzene Hexachloride	Taubmans Qld. Pty. Ltd., 95 Edward street, Brisbane
Rudust No. 14 10% BHC in China Clay	1·3	gamma isomer of Benzene Hexachloride	Taubmans Qld. Pty. Ltd., 95 Edward street, Brisbane

BISULPLHIDE OF CARBON.

I.C.I.A.N.Z. Carbon Bisulphide	99·0	Carbon Bisulphide	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane

BORDEAUX MIXTURE (COPPER LIME).

Lane's Bordo Powder	12·5	Copper (Cu) as Copper Oxychloride	A.G. Bignold & Co., 169 Elizabeth street, Brisbane

CATTLE DIP CONCENTRATES.

ARSENICAL LIQUID.

(a) Dilution less than 1 in 200—

Non-Ox Liquid Cattle Dip	32·0	Arsenic Trioxide (As_2O_3)	Australian Chemical Co. Pty. Ltd., 305 Montague road, South Brisbane
	4·5	Cresylic Acid (dilution 1 in 160)	
Australian Liquid Dip	32·0	Arsenic Trioxide (As_2O_3)	H. Blaiklock & Co. Pty. Ltd., 150 Mary street, Brisbane
	4·5	Phenols and Cresols (dilution 1 in 160)	
Queensland Cattle Dip (Homogeneous)	32·0	Arsenic Trioxide (As_2O_3)	Dalgety & Co. Ltd., Elizabeth street, Brisbane
	12·0	Cresols (dilution 1 in 160)	
Royal Cattle Dip (Homogeneous)	32·0	Arsenic Trioxide (As_2O_3)	Dalgety & Co. Ltd., Elizabeth street, Brisbane
	12·0	Cresols (dilution 1 in 160)	
Tickstroy Cattle Dip	32·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 160)	J. H. Eden & Co., 283 Lutwyche road, Lutwyche, Brisbane
Kiltic Liquid Cattle Dip	32·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 160)	G. Horsburgh & Co. Pty. Ltd., 320 Kent street, Maryborough
Mactaggarts' Improved Liquid Cattle Dip	32·0	Arsenic Trioxide (As_2O_3)	Mactaggarts P.P. Co-op. Assn., Ltd., Eagle street, Brisbane
	4·5	Phenols and Cresols (dilution 1 in 160)	
Cooper's Improved Cattle Dip	20·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 125)	New Zealand Loan & Mercantile Agency Co. Ltd., Eagle street, Brisbane
Sidolia Liquid Cattle Dip	32·0	Arsenic Trioxide (As_2O_3)	Norris Agencies Pty. Ltd., 639 Ann street, Brisbane
	4·5	Cresylic Acid (dilution 1 in 160)	
Standard Liquid Cattle Dip 1–160	32·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 160)	Queensland Chemical & Distributing Co., 107 Eagle street, Brisbane
Kiltic Liquid Cattle Dip	32·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 160)	Surgical Supplies Ltd., 428 Queen street, Brisbane
United Cattle Dip	32·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 160)	United Chemicals Pty. Ltd., 91–7 Montague road, South Brisbane
Little's Cattle Dip	23·0	Arsenic Trioxide (As_2O_3) w/w (dilution 1 in 160)	Wilcox, Moffin Ltd., Albert street, Brisbane
"Apollo" Cattle Dip Single Strength	32·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 160)	Winchcombe, Carson Ltd., 99 Eagle street, Brisbane

LIST OF PEST DESTROYERS REGISTERED IN QUEENSLAND UNDER "THE PEST DESTROYERS ACT OF 1939."—*continued.*

For the Period Commencing January, 1949, as at 2nd December, 1949.

Name of Pest Destroyer.	Active Constituents as Declared by Seller.		Queensland Wholesale Dealer.
		CATTLE DIP CONCENTRATES—*continued.*	
ARSENICAL—LIQUID—*continued.*			
(*b*) Dilution 1 in 300 and over—			
"Acco" 1–300 Liquid Cattle Dip	60·0	Arsenic Trioxide (As_2O_3)	Australian Chemical Co. Pty., Ltd., 305 Montague road, South Brisbane
	9·5	Creslyic Acid (dilution 1 in 300)	
Australian Double Strength Liquid Dip	64·0	Arsenic Trioxide (As_2O_3)	H. Blaiklock & Co. Pty. Ltd., 150 Mary street, Brisbane
	10·0	Cresols and Phenols (dilution 1 in 320)	
Royal Cattle Dip (Concentrated)	35·0	Arsenic Trioxide (As_2O_3) w/w (dilution 1 in 300)	Dalgety & Co. Ltd., Elizabeth street, Brisbane
Ex-L-Col 1–320 Liquid Cattle Dip	64·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 320)	Denham Bros. (R'ton) Pty. Ltd., East street, Rockhampton
Tickstroy (Double Strength) Cattle Dip	64·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 320)	J. H. Eden & Co., 483 Lutwyche road, Lutwyche, Brisbane
Harton Cattle Dip	64·0	Arsenic Trioxide (As_2O_3)	Goldsborough, Mort & Co. Ltd., Eagle street, Brisbane
	7·2	Cresols (dilution 1 in 320)	
Hayes' Cattle Dip	60·0	Arsenic Trioxide (As_2O_3)	Hayes Veterinary Co., 351 Queen street, Brisbane
	9·5	Cresylic Acid (dilution 1 in 300)	
"Vallo" Improved Fluid Cattle Dip Double Strength	64·0	Arsenic Trioxide (As_2O_3)	A. Victor Leggo & Co Pty. Ltd., 185 Mary street, Brisbane
	7·35	Creslyic Acid (dilution 1 in 320)	
Maxdip Double Strength Cattle Dip	64·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 320)	Mactaggarts P.P. Co-op. Assn. Ltd., Eagle street, Brisbane
Cooper's Tixol	64·0	Arsenic Trioxide (As_2O_3)	New Zealand Loan & Mercantile Agency Co. Ltd., Eagle street, Brisbane
	5·2	Cresylic Acid (dilution 1 in 320)	
Sidolia Highly Concentrated Liquid Cattle Dip	64·0	Arsenic Trioxide (As_2O_3)	Norris Agencies Pty. Ltd., 639 Ann street, Brisbane
	10·0	Creslyic Acid (dilution 1 in 320)	
Osmond's "Forty-One" Cattle Dip	65·66	Arsenic Trioxide (As_2O_3) (dilution 1 in 325)	Osmonds & Sons (Aust.) Pty. Ltd., 500 Stanley street, South Brisbane
P.C.D. 1–320 Liquid Cattle Dip	64·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 320)	Port Curtis Co-op. Dairy Assn. Ltd., O'Connell street, Gladstone
Young's Improved Cattle Dip	64·0	Arsenic Trioxide (As_2O_3)	Producers Co-op. Dist. Soc. Ltd., Turbot street, Brisbane
	5·0	Cresylic Acid and Homologues (dilution 1 in 320)	
Standard Liquid Cattle Dip, Double Strength, 1–300	60·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 300)	Queensland Chemical & Distributing Co., 107 Eagle street, Brisbane
Hibiscus Cattle Dip Fluid	64·0	Arsenic Trioxide (As_2O_3)	Queensland Pastoral Supplies Pty. Ltd., Bowen street, Brisbane
	7·2	Cresylic Acid (dilution 1 in 320)	
Young's Standard Sodium Arsenite Cattle Dip	64·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 320)	Queensland Primary Producers Co-op. Assn. Ltd., Creek street, Brisbane
Kiltic Concentrated Liquid Cattle Dip	60·0	Arsenic Trioxide (As_2O_3)	Surgical Supplies Ltd., 428 Queen street, Brisbane
	9·5	Tar Acids (dilution 1 in 300)	
Tropik 1–320 Liquid Cattle Dip	64·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 320)	Tropical Dip & Chemical Co., Cambridge street, Rockhampton
Uccol Cattle Dip	64·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 320)	United Chemicals Pty. Ltd., 91–7 Montague road, South Brisbane
Little's Cattle Dip (Concentrated)	60·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 300)	Wilcox, Mofflin Ltd., Albert street, Brisbane
"Apollo" Cattle Dip, Double Strength	60·0	Arsenic Trioxide (As_2O_3) (dilution 1 in 300)	Winchcombe Carson Ltd., 99 Eagle street, Brisbane
ARSENICAL—PASTE.			
Thomas' Carbolised Cattle Wash	35·2	Arsenic Trioxide (As_2O_3)	James Campbell & Sons Pty. Ltd., Creek street, Brisbane
	0·25	Cresylic Acid (10lb. to 175 gallons)	
BENZENE HEXACHLORIDE—LIQUID.			
Royal A.R.T. Cattle Dip	6·0	gamma isomer of Benzene Hexachloride	Dalgety & Co. Ltd., Elizabeth street, Brisbane
Cooper's Gamatik Cattle Dip	6·0	gamma isomer of Benzene Hexachloride	New Zealand Loan & Mercantile Agency Co. Ltd., Eagle street, Brisbane
Little's Altik Cattle Dip	6·0	gamma isomer of Benzene Hexachloride	Wilcox, Mofflin Ltd., Albert street, Brisbane
BENZENE HEXACHLORIDE—PASTE.			
Young's Sovereign Paste Cattle Dip	6·5	gamma isomer of Benzene Hexachloride	Queensland Primary Producers' Co-op. Assn. Ltd., Creek street, Brisbane

Product	%	Active constituent	Distributor
BENZENE HEXACHLORIDE AND DDT.			
Osmond's "Vitix" Cattle Dip	25·0	para para dichlordiphenyltrichlorethane	Osmond & Sons (Aust.) Pty. Ltd., 500 Stanley street, South Brisbane
	1·5	gamma isomer of Benzene Hexachloride	
	5·0	Cresylic Acid	
CHLORATE WEED KILLERS.			
A.C.F. Sodium Chlorate Non-Poisonous Weed Killer	100·0	Commercial Sodium Chlorate	A.C.F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
Atlacide C.A. Chlorate Weed Killer	19·2	Chlorine (Cl) as Calcium Chloride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
	20·0	Chlorine (Cl) as Sodium Chlorate	
Elliott's Vertan	33·0	Chlorine (Cl) as Sodium Chlorate	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
COPPER DUSTS.			
I.C.I. Copper Carbonate	52·0	Copper (Cu) as Copper Carbonate	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Smutol	52·0	Copper (Cu) as Copper Oxychloride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
"Vallo" Anti-Bunt	50·0	Copper (Cu) as Copper Oxychloride	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
COPPER SPRAYS.			
Aeroflo C–O–C– Spray	50·0	Copper (Cu) as Copper Oxychloride	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
F.D.L. Copper Spray	50·0	Copper (Cu) as Copper Oxychloride	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
Bordinette	12·7	Copper (Cu) as Copper Sulphate	Qld. Fruitgrowers' Co-op. Soc. Ltd., Makerston street, Brisbane
COPPER SULPHATE.			
Bluestone	25·0	Copper (Cu) as Copper Sulphate	A.C.F. & Shirleys Fertilizers Ltd., Little Roma Street, Brisbane
Bluestone (Copper Sulphate)	25·0	Copper (Cu) as Copper Sulphate	G. Horsburgh & Co. Pty. Ltd., 320 Kent street, Maryborough
CYANIDE.			
Cyanogas	42·0	Calcium Cyanide ($Ca(CN)_2$)	Buzacotts (Qld.), Ltd., 443 Adelaide street, Petrie Bight, Brisbane
DERRIS PREPARATIONS.			
Nosco Derris Dust	0·75	Rotenone from Derris	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
	1·25	Total Ether Extractives from Derris	
Houghton's Derridust No. 1	0·8	Rotenone from Derris	Houghton & Byrne Pty., Ltd., Queen street, Brisbane
	3·0	Total Ether Extractives from Derris	
Pulvex Vermin Powder	1·0	Rotenone from Derris	New Zealand Loan & Mercantile Agency Co. Ltd., Eagle street, Brisbane
	3·0	Total Ether Extractives from Derris	
Katakilla	1·0	Rotenone from Derris	Queensland Fruitgrowers Co-op. Soc. Ltd., Makerston street, Brisbane
	4·0	Total Ether Extractives from Derris	
Hart's Agricultural Pestide	0·025	Rotenone from Derris	Queensland Pastoral Supplies Pty. Ltd., Bowen street, Brisbane
	0·1	Total Ether Extractives from Derris	
	35·0	Potassium and Ammonium Oleate	
	2·0	Oil of Citronella	
Elliott's Rodeo	0·625	Rotenone from Derris	Taylors, Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
	2·5	Total Ether Extractives from Derris	
	35·0	Cresylic Acid	
DUSTING MIXTURES.			
BENZENE HEXACHLORIDE & DDT.			
Aeroflo DDT 113	1·0	para para dichlordiphenyltrichlorethane	Aeroflo Dusts & Sprays Pty., Redland Bay Road, Redland Bay
	0·13	gamma isomer of Benzene Hexachloride	
Aeroflo DG. 226	2·0	para para dichlordiphenyltrichlorethane	Aeroflo Dusts & Sprays Pty., Redland Bay Road, Redland Bay
	0·26	gamma isomer of Benzene Hexachloride	
Gammexane No. 4 Dust	0·5	gamma isomer of Benzene Hexachloride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Pespruf No. 2G Dust	1·0	para para dichlordiphenyltrichlorethane	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
	0·13	gamma isomer of Benzene Hexachloride	
Pespruf No. 4G Dust	2·0	para para dichlordiphenyltrichlorethane	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
	0·26	gamma isomer of Benzene Hexachloride	
Neptune Float-On Dust No. 8	2·0	para para dichlordiphenyltrichlorethane	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
	0·26	gamma isomer of Benzene Hexachloride	

LIST OF PEST DESTROYERS REGISTERED IN QUEENSLAND UNDER "THE PEST DESTROYERS ACT OF 1939."—*continued.*

For the Period Commencing January, 1949, as at 2nd December, 1949.

DUSTING MIXTURES—*continued.*

Name of Pest Destroyer.	Per cent.	Active Constituents as Declared by Seller.	Queensland Wholesale Dealer.
BENZENE HEXACHLORIDE & DDT.—*cont'd.*			
Plane Brand Noxide No. 100 G2	1·0 0·26	para para dichlordiphenyltrichlorethane gamma isomer of Benzene Hexachloride	Queensland Fruitgrowers' Co-op. Soc. Ltd., Makerston street, Brisbane
Vege-Dust (Noxide 100 G4)	1·0 0·4	para para dichlordiphenyltrichlorethane gamma isomer of Benzene Hexachloride	Queensland Fruitgrowers' Co-op. Soc. Ltd., Makerston street, Brisbane
Rudust No. 8 Duplex Cabbage Dust	2·0 0·26	para para dichlordiphenyltrichlorethane gamma isomer of Benzene Hexachloride	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
A.C.F. Peskil	2·0 7·0 40·0	para para dichlordiphenyltrichlorethane Copper (Cu) as Copper Oxychloride Sulphur (S) as Powdered Sulphur	A.C.F. & Shirley Fertilizers Ltd., Little Roma street, Brisbane
Aeroflo CD 72 Dust	7·0 2·0	Copper (Cu) as Copper Oxychloride para para dichlordiphenyltrichlorethane	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
Aeroflo CSD 7402 Dust	7·0 40·0 2·0	Copper (Cu) as Copper Oxychloride Sulphur (S) as Powdered Sulphur para para dichlordiphenyltrichlorethane	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
Aeroflo CSD 10/402 Dust	10·0 40·0 2·0	Copper (Cu) as Copper Oxychloride Sulphur (S) as Powdered Sulphur para para dichlordiphenyltrichlorethane	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
Aeroflo DS 260 Dust	2·0 60·0	para para dichlordiphenyltrichlorethane Sulphur (S) as Powdered Sulphur	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
Lane's Tomato Dust No. 1	2·0 42·0 4·0	para para dichlordiphenyltrichlorethane Sulphur (S) Copper (Cu) as Copper Oxychloride	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Nosco Brand Composite Dust	2·0 0·1 25·0	para para dichlordiphenyltrichlorethane Pyrethrins Tobacco Dust	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Garden Brand DDT Combined Dust	1·0 0·5 1·2	para para dichlordiphenyltrichlorethane Rotenone } from Total Ether Extractives } Timbo	Cloudust Spray Manufacturers, Montague road, South Brisbane
F.D.L. No. 4 Dust	2·0 7·0 40·0	para para dichlordiphenyltrichlorethane Copper (Cu) as Copper Oxychloride Sulphur (S) as Ground Sulphur	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
Pespruf No. 5 Dust	2·0 7·5	para para dichlordiphenyltrichlorethane Copper (Cu) as Basic Copper Carbonate	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Pespruf No. 3 Dust	2·0 7·0	para para dichlordiphenyltrichlorethane Copper (Cu) as Basic Copper Carbonate	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Neptune Float-On Dust No. 4	2·0 0·13	para para dichlordiphenyltrichlorethane Total Pyrethrins	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
Neptune Float-On Dust No. 5	2·0 5·0	para para dichlordiphenyltrichlorethane Copper (Cu) as Copper Oxychloride	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
Plane Brand Azurine No. 200	2·0 7·0 40·0	para para dichlordiphenyltrichlorethane Copper (Cu) as Copper Oxychloride Sulphur (S) as Powdered Sulphur	Queensland Fruitgrowers Co-op. Soc. Ltd., Makerston street, Brisbane
Pestox No. 3 DDT Dust	2·0 0·23 20·0	para para dichlordiphenyltrichlorethane Total Pyrethrins Sulphur (S)	L. L. Strange, Rep. Samuel Taylor Pty. Ltd., "Sunnyside," Miles street, Hawthorne, Brisbane
Pestox No. 5 DDT Dust	2·0 5·0 40·0	para para dichlordiphenyltrichlorethane Copper (Cu) as Copper Carbonate Sulphur (S)	L. L. Strange, Rep. Samuel Taylor Pty. Ltd., "Sunnyside," Miles street, Hawthorne, Brisbane

Rudust No. 7 Tropical Tomato Dust	2·0	para para dichlordiphenyltrichlorethane	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
	50·0	Sulphur (S) as Finely Ground Sulphur	
	7·0	Copper (Cu) as Copper Carbonate	
Rudust Tomato Dust No. 2	2·0	para para dichlordiphenyltrichlorethane	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
	50·0	Sulphur (S) as Finely Ground Sulphur	
MISCELLANEOUS.			
A.C.F. Blight Dust	7·28	Copper (Cu) as Copper Carbonate	A.C.F. & Shirleys Fertilizers, Ltd., Little Roma street, Brisbane
	40·0	Sulphur (S) as Powdered Sulphur	
A.C.F. Complete Dust	7·75	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
	5·0	Copper (Cu) as Dehydrated Copper Sulphate	
	2·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	
	20·0	Sulphur (S) as Powdered Sulphur	
A.C.F. Copper Lead Dust	5·0	Copper (Cu) as Dehydrated Copper Sulphate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
	10·0	Sulphur (S) as Powdered Sulphur	
	12·4	Arsenic Pentoxide (As_2O_5) as Lead Arsenate	
A.C.F. Copper Sulphate Dust	5·0	Copper (Cu) as Dehydrated Copper Sulphate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
	10·0	Sulphur (S) as Powdered Sulphur	
A.C.F. Grub and Aphis Dust	7·75	Arsenic Pentoxide (As_2O_5) as Lead Arsenate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
	2·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	
A.C.F. Home Garden Dusting Powder	7·75	Arsenic Pentoxide (As_2O_5) as Lead Arsenate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
	5·4	Copper (Cu) Dehydrated Copper Sulphate	
	2·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	
	20·0	Sulphur (S) as Powdered Sulphur	
A.C.F. Special Blight Dust	10·0	Copper (Cu) as Copper Carbonate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
	40·0	Sulphur (S) as Powdered Sulphur	
A.C.F. Special Grub and Aphis Dust	15·5	Arsenic Pentoxide (As_2O_5) as Lead Arsenate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
	2·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	
A.C.F. Special Grub Dust	15·5	Arsenic Pentoxide (As_2O_5) as Lead Arsenate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
A.C.F. Special Tomato Dust	7·0	Copper (Cu) as Copper Carbonate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
	40·0	Sulphur (S) as Powdered Sulphur	
	12·0	Arsenic Pentoxide (As_2O_5) as Lead Arsenate	
A.C.F. Tomato 50 Dust	7·0	Copper (Cu) as Copper Carbonate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
	20·0	Sulphur (S) as Powdered Sulphur	
	15·5	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	
A.C.F. Tomato and Melon Dust	7·28	Copper (Cu) as Copper Carbonate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
	40·0	Sulphur (S) as Powdered Sulphur	
	7·75	Arsenic Pentoxide (As_2O_5) as Lead Arsenate	
Aeroflo CS. 740 Dust	7·0	Copper (Cu) as Copper Oxychloride	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
	40·0	Sulphur (S) as Powdered Sulphur	
Aeroflo CS. 760 Dust	7·0	Copper (Cu) as Copper Oxychloride	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
	60·0	Sulphur (S) as Powdered Sulphur	
Aeroflo CS. 1140 Dust	11·0	Copper (Cu) as Copper Oxychloride	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
	40·0	Sulphur (S) as Powdered Sulphur	
Aeroflo CSL. 25 Dust	7·0	Copper (Cu) as Copper Oxychloride	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
	40·0	Sulphur (S) as Powdered Sulphur	
	7·75	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	
Aeroflo CSL. 40 Dust	7·0	Copper (Cu) as Copper Oxychloride	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
	40·0	Sulphur (S) as Powdered Sulphur	
	12·0	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	
Aeroflo CSL 40X Dust	10·0	Copper (Cu) as Copper Oxychloride	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
	20·0	Sulphur (S) as Powdered Sulphur	
	12·0	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	
Aeroflo CSL 50 Dust	7·0	Copper (Cu) as Copper Oxychloride	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
	20·0	Sulphur (S) as Powdered Sulphur	
	15·5	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	
Aeroflo LN 502 Dust	15·5	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
	2·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	
Aeroflo S 90 Dust	90·0	Sulphur (S) as Powdered Sulphur	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
Aeroflo SN 502 Dust	50·0	Sulphur (S) as Powdered Sulphur	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
	2·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	

LIST OF PEST DESTROYERS REGISTERED IN QUEENSLAND UNDER "THE PEST DESTROYERS ACT OF 1939."—*continued.*

For the Period Commencing January, 1949, as at 2nd December, 1949.

Name of Pest Destroyer.	Per cent.	Active Constituents as Declared by Seller.	Queensland Wholesale Dealer.
		DUSTING MIXTURES—*continued.*	
MISCELLANEOUS—*continued.*			
Cloudust Blight Dust	7·5	Copper (Cu) as Copper Carbonate	Cloudust Spray Manufacturers, Montague road, South Brisbane
	30·0	Sulphur (S) as Ground Sulphur	
Cloudust Tomato Dust Special ..	12·2	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	Cloudust Spray Manufacturers, Montague road, South Brisbane
	7·5	Copper (Cu) as Copper Carbonate	
	30·0	Sulphur (S) Ground Sulphur	
Waratah Brand Dust No. 1	5·0	Copper (Cu) as Copper Carbonate	Committee of Direction of Fruit Marketing, Turbot street, Brisbane
	20·0	Sulphur (S) as Ground Sulphur	
F.D.L. Dust No. 1	7·0	Copper (Cu) as Copper Oxychloride ..	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
	40·0	Sulphur (S) as Ground Sulphur	
F.D.L. Dust No. 2	11·0	Copper (Cu) as Copper Oxychloride ..	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
	35·0	Sulphur (S) as Ground Sulphur	
F.D.L. Dust No. 3	12·5	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
	7·0	Copper (Cu) as Copper Oxychloride ..	
	40·0	Sulphur (S) as Ground Sulphur	
"Vallo" Dusting Compound A.L. 50 ..	16·0	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
"Vallo" Dusting Compound N3 AL. 30	3·0	Nicotine ($C_{10}H_{14}N_2$)	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
	9·6	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	
"Vallo" Tomato and Vegetable Dusting Compound No. 1	15·0	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
	5·0	Copper (Cu) as Copper Oxychloride ..	
	40·0	Sulphur (S)	
"Vallo" Tomato and Vegetable Dusting Compound No. 2	7·5	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
	5·0	Copper (Cu) as Copper Oxychloride ..	
	40·0	Sulphur (S)	
Neptune Float-On Dust No. 6 ..	15·0	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
	5·0	Copper (Cu) as Copper Oxychloride ..	
	40·0	Sulphur (S) as Powdered Sulphur	
Plane Brand Azurine No. 2 Dust ..	7·0	Copper (Cu) as Copper Oxychloride ..	Queensland Fruitgrowers Co-op. Soc. Ltd., Makerston street, Brisbane
	40·0	Sulphur (S) as Powdered Sulphur	
Plane Brand Azurine No. 4 Dust ..	11·0	Copper (Cu) as Copper Oxychloride ..	Queensland Fruitgrowers Co-op. Soc. Ltd., Makerston street, Brisbane
	35·0	Sulphur (S) as Powdered Sulphur	
Plane Brand Azurine No. 25 Dust ..	7·0	Copper (Cu) as Copper Oxychloride ..	Queensland Fruitgrowers Co-op. Soc. Ltd., Makerston street, Brisbane
	40·0	Sulphur (S) as Powdered Sulphur	
	7·5	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	
Plane Brand Azurine No. 40 Dust ..	7·0	Copper (Cu) as Copper Oxychloride ..	Queensland Fruitgrowers Co-op. Soc. Ltd., Makerston street, Brisbane
	40·0	Sulphur (S) as Powdered Sulphur	
	12·0	Arsenic Pentoxide (As_2O_5) as Arsenate of Lead	
		DDT PREPARATIONS.	
A.C.F. DDT 2 per cent. Dust	2·0	para para dichlordiphenyltrichlorethane ..	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
A.C.F. DDT 4 per cent. Solution	4·0	para para dichlordiphenyltrichlorethane ..	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
A.C.F. 20 per cent. DDT Spray	20·0	para para dichlordiphenyltrichlorethane ..	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
Aeroflo DDT 200 Dust	2·0	para para dichlordiphenyltrichlorethane ..	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
Kylpest	5·0	para para dichlordiphenyltrichlorethane ..	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
	4·0	Total Ether Extractives } from Barbascue Root	
	1·3	Rotenone .. .. } from Barbascue Root	

Lane's Emulsane 20 DDT Emulsion	20·0	para para dichlordiphenyltrichlorethane	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Lane's No-Verm Dust	2·0	para para dichlordiphenyltrichlorethane	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Lane's Wellspray 50 Dispersible 50 per cent. DDT Powder	50·0	para para dichlordiphenyltrichlorethane	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Lane's Wellspray Emulsion	25·0	para para dichlordiphenyltrichlorethane	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Australian 20 per cent. DDT Emulsion	20·0	para para dichlordiphenyltrichlorethane	H. Blaiklock & Co. Pty. Ltd. 150 Mary street, Brisbane
Taylor's No. 13 DDT Emulsion Concentrate	9·5	para para dichlordiphenyltrichlorethane	F. C. Rowley, Rep. British Paints (Aust.) Pty. Ltd., 115 Queen street, Brisbane
Taylor's No. 13 DDT Powder	5·0	para para dichlordiphenyltrichlorethane	F. C. Rowley, Rep. British Paints (Aust.) Pty. Ltd., 115 Queen street, Brisbane
Garden Brand Blue Label Dispersable DDT Powder	40·0	para para dichlordiphenyltrichlorethane	Cloudust Spray Manufacturers, Montague road, South Brisbane
Garden Brand DDT 2 per cent.	2·0	para para dichlordiphenyltrichlorethane	Cloudust Spray Manufacturers, Montague road, South Brisbane
Garden Brand Green Label Dispersable DDT Powder	40·0	para para dichlordiphenyltrichlorethane	Cloudust Spray Manufacturers, Montague road, South Brisbane
Bufidi	5·0	para para dichlordiphenyltrichlorethane	Denham Bros. (R'ton) Pty. Ltd., East street, Rockhampton
Ex–L–Col 5 per cent. DDT Emulsion	5·0	para para dichlordiphenyltrichlorethane	Denham Bros. (R'ton) Pty. Ltd., East street, Rockhampton
F.D.L. DDT 2 per cent. Dust	2·0	para para dichlordiphenyltrichlorethane	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
F.D.L. 20 per cent. Emulsion	20·0	para para dichlordiphenyltrichlorethane	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
F.D.L. DDT 50 Spray	50·0	para para dichlordiphenyltrichlorethane	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
Magic Pest & Vermin Exterminator	10·0	para para dichlordiphenyltrichlorethane	Gibbs, Bright & Co., 406 Queen street, Brisbane
Mag-O-Tol plus DDT	4·0 1·0	Cresylic Acid para para dichlordiphenyltrichlorethane	Goldsborough, Mort & Co. Ltd., Eagle street, Brisbane
I.C.I. Buffalo Fly Emulsion No. 1	15·0	para para dichlordiphenyltrichlorethane	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Pespruf 50 per cent. Dispersible Powder	50·0	para para dichlordiphenyltrichlorethane	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Pespruf No. 2 Dust	2·0	para para dichlordiphenyltrichlorethane	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
"Vermpruf" 1A	12·5	para para dichlordiphenyltrichlorethane	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queenstreet, Brisbane
Chemist Roush DDT All Purpose Insect Spray	3·2	para para dichlordiphenyltrichlorethane	Morden Laboratories, 66 Charlotte street, Brisbane
Chemist Roush DDT Dog Soap	2·0	para para dichlordiphenyltrichlorethane	Morden Laboratories, 66 Charlotte street, Brisbane
Chemist Roush Fly and Insect Spray	0·1 0·4	Active Pyrethrins para para dichlordiphenyltrichlorethane	Morden Laboratories, 66 Charlotte street, Brisbane
Morden Flea and Vermin Powder for Dogs	5·0	para para dichlordiphenyltrichlorethane	Morden Laboratories, 66 Charlotte street, Brisbane
Neptune Aphidol	4·0 78·0	para para dichlordiphenyltrichlorethane Refined Mineral Oil	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
Neptune DDT Dispersible Powder	40·0	para para dichlordiphenyltrichlorethane	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
Neptune DDT Spraying Emulsion	32·0	para para dichlordiphenyltrichlorethane	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
Neptune Float-On Dust No. 1	5·0	para para dichlordiphenyltrichlorethane	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
Neptune Float-On Dust No. 2	2·0	para para dichlordiphenyltrichlorethane	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
Insectibane	0·587 2·0	Total Pyrethrins (1 and 2) para para dichlordiphenyltrichlorethane	Nobles Pty. Ltd., cnr. Charlotte and Eagle streets, Brisbane
Wonderdog Tick Powder	10·0 1·0 3·0	para para dichlordiphenyltrichlorethane Rotenone } from Total Ether Extractives } Derris	Northern Veterinary Remedies, 146 Flinders street, Townsville
Wonderdog Vermin Powder	3·0 1·0 3·0	para para dichlordiphenyltrichlorethane Rotenone } from Total Ether Extractives } Derris	Northern Veterinary Remedies, 146 Flinders street, Townsville
Krect Vermin Powder	1·0 4·0 2·0	Rotenone } from Total Ether Extractives } Derris para para dichlordiphenyltrichlorethane	A. Light, Rep. Nyal Co., care of Frederick Stearns & Co. Division, cnr. Albert and Margaret streets, Brisbane
P.C.D. Fli-Tik-Di	20·0	para para dichlordiphenyltrichlorethane	Port Curtis Co-op. Dairy Assn. Ltd., O'Connell street, Gladstone
Mothdust 2 per cent. DDT	2·0	para para dichlordiphenyltrichlorethane	The Potato Growers Co-op. Trading Soc. Ltd., 369 George street, Brisbane
Kilsect 20 per cent. DDT Emulsion Concentrate	20·0	para para dichlordiphenyltrichlorethane	Queensland Chemical & Dist. Co., 107 Eagle street, Brisbane
Dee Dust	2·0	para para dichlordiphenyltrichlorethane	Queensland Fruitgrowers' Co-op. Soc. Ltd., Makerston street, Brisbane
Hibiscus DDT Emulsion Concentrate	20·0	para para dichlordiphenyltrichlorethane	Queensland Pastoral Supplies Pty. Ltd., 27 Bowen street, Brisbane
Toxol DDT Vermin Powder	2·0	para para dichlordiphenyltrichlorethane	Queensland Pastoral Supplies Pty. Ltd., 27 Bowen street, Brisbane
Kadol Concentrated 20 per cent. DDT Emulsion	20·0	para para dichlordiphenyltrichlorethane	E. Rich & Co. Pty. Ltd., 23–37 Wharf street, Brisbane
Verm–X Insect Powder	3·0 0·65	para para dichlordiphenyltrichlorethane Pyrethrins	E. Rich & Co. Pty. Ltd., 23–37 Wharf street, Brisbane

1950 SHOW DATES.

April.

Blackbutt ..	13, 14 and 15
Chinchilla ..	13, 14 and 15
Miles	20, 21 and 22
Monto	26 and 27
Taroom ..	26, 27 and 28
Nanango ..	27, 28 and 29
Wallumbilla ..	27 and 29

May.

Eidsvold ..	1 and 2
Roma	2, 3 and 4
Kingaroy ..	4, 5 and 6
Beaudesert ..	5 and 6
Inglewood ..	5 and 6
Wondai ..	11, 12 and 13
Marburg ..	12 and 13
Ipswich ..	16, 17 and 18
Blackall ..	16 and 17
Charleville ..	17 and 18
Biggenden ..	18 and 19
Murgon ..	18, 19 and 20
Thangool ..	19 and 20
Warrill View ..	20
Biloela	25 and 26
Gympie ..	25, 26 and 27
Crow's Nest ..	26 and 27
Kalbar	27

June.

Maryborough ..	1, 2 and 3
Wowan	1, 2 and 3
Boonah ..	2 and 3
Childers ..	5 and 6
Bundaberg ..	8, 9 and 10
Mt. Morgan ..	8, 9 and 10
Lowood ..	9, 10 and 12
Gin Gin ..	12 and 13
Gladstone ..	15, 16 and 17
Toogoolawah ..	16 and 17
Rockhampton ..	21, 22, 23 and 24
Kilcoy	23 and 24
Mackay ..	27, 28 and 29
Esk	30 and 1st July
Proserpine ..	30 and 1st July
Home Hill ..	30 and 1st July

July.

Bowen	5 and 6
Nambour ..	6, 7 and 8
Ayr	7 and 8
Laidley ..	7 and 8
Townsville ..	11, 12, and 13
Maleny ..	13 and 14
Ingham ..	14 and 15
Rosewood ..	14 and 15
Cairns	18, 19 and 20
Gatton ..	20, 21 and 22
Redlands .	21 and 22
Tully	21 and 22
Woodford ..	21 and 22
Atherton ..	25 and 26
Innisfail ..	28 and 29
Lawnton ..	28 and 29

August.

Brisbane ..	5 to 12
Redcliffe ..	18 and 19

September.

Canungra ..	2
Beenleigh ..	15 and 16

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 13th MARCH, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas.
Jersey	W. E. O. Meier, "Kingsford" Stud, Rosevale, via Rosewood.
A.I.S.	F. B. Sullivan, "Fermagh," Pittsworth.
Ayrshire	L. Holmes, "Beneecula," Yarranlea.
A.I.S.	D. Sullivan, Rossvale, via Pittsworth.
A.I.S.	W. Henschell, Yarranlea.

MAY.

By W. J. Newell, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.13	5.17	Cairns	12	46	Longreach	28	42
6	6.16	5.13	Charleville ..	25	29	Quilpie	36	34
11	6.19	5.09	Cloncurry	38	61	Rockhampton ..	2	18
16	6.21	5.06	Cunnamulla ..	30	28	Roma	16	18
21	6.24	5.04	Dirranbandi ..	21	17	Townsville ..	11	38
26	6.27	5.02	Emerald	13	26	Winton	31	50
31	6.29	5.00	Hughenden ..	23	47	Warwick	5	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	4.26	4.43
2	5.07	5.53
3	5.54	7.06
4	6.48	8.20
5	7.48	9.31
6	8.53	10.35
7	10.00	11.31
		p.m.
8	11.04	12.18
9	..	12.56
	a.m.	
10	12.04	1.30
11	1.01	2.00
12	1.55	2.27
13	2.48	2.54
14	3.40	3.22
15	4.33	3.50
16	5.26	4.22
17	6.22	4.59
18	7.18	5.39
19	8.15	6.26
20	9.09	7.19
21	10.00	8.15
22	10.46	9.15
23	11.28	10.15
	p.m.	
24	12.05	11.16
25	12.40	..
		a.m.
26	1.13	12.18
27	1.45	1.19
28	2.19	2.23
29	2.57	3.29
30	3.40	4.39
31	4.31	5.52

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	24	15	40	31	15	7	46	35
6	30	9	46	23	21	0	54	26
11	23	16	39	32	14	8	45	36
16	13	27	28	42	3	18	31	50
21	9	30	25	45	0	21	26	53
26	17	23	33	39	8	14	37	44
31	33	11	45	25	20	0	53	28

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	40	21	57	44	42	29	33	18
3	52	8	66	36	50	21	43	8
5	57	2	69	32	53	17	47	3
7	53	4	67	33	50	19	44	5
9	43	12	60	38	45	24	36	12
11	38	23	56	45	41	30	32	29
13	27	32	49	53	33	38	23	28
15	18	42	42	59	27	44	16	36
17	9	51	37	64	21	50	8	43
19	2	56	33	67	17	53	3	46
21	2	55	33	67	17	52	3	45
23	9	47	37	62	21	47	8	39
25	19	37	42	56	27	41	17	32
27	31	31	51	51	35	36	25	26
29	43	18	59	43	44	27	36	17
31	54	6	67	34	51	20	44	7

Phases of the Moon.—Full Moon, 2nd May, 3.19 p.m.; Last Quarter, 9th May, 8.32 a.m.; New Moon, 17th May, 10.54 a.m.; First Quarter, 25th May, 7.28 a.m.

On 15th May the Sun will rise and set 20 degrees north of true east and true west respectively, and on the 12th and 27th the Moon will rise and set at true east and true west.

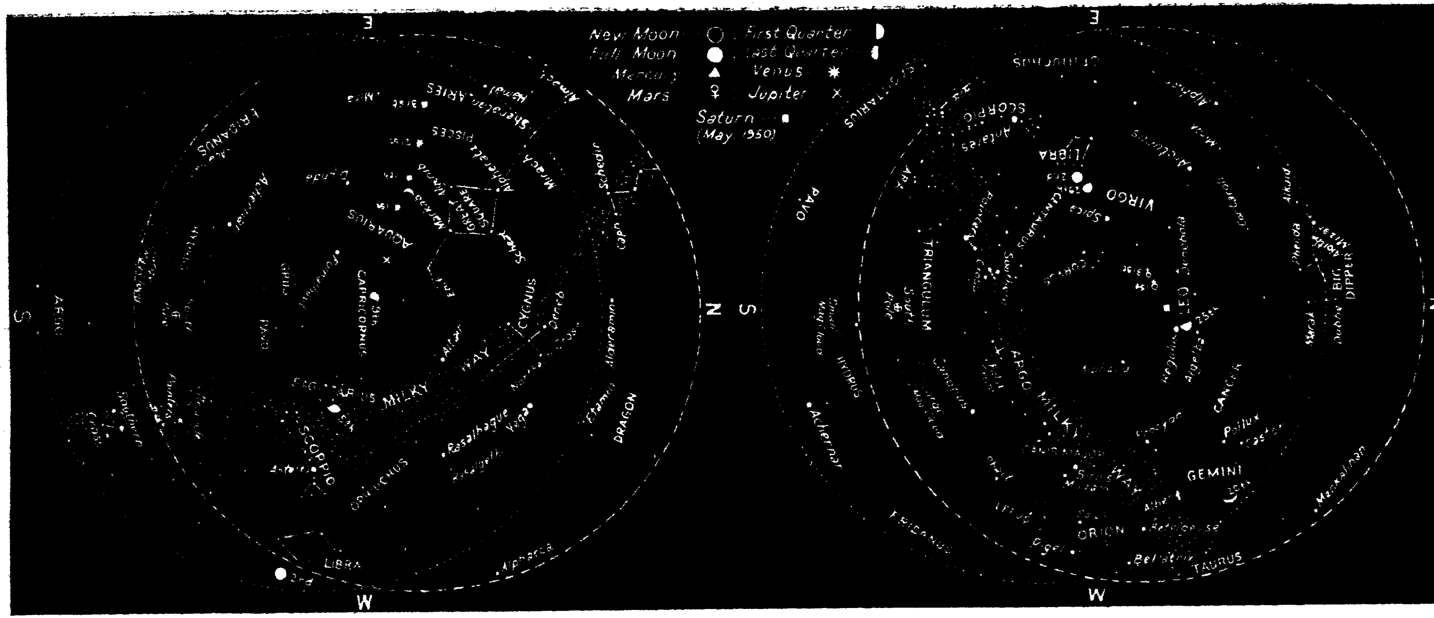
Mercury.—An evening object at the beginning of the month when in the constellation of Taurus, it will set 50 minutes after the Sun, but on the 14th it will be in line with the Sun, after which it will pass into the morning sky and by the end of the month, in the constellation of Aries, will rise 1½ hours before Sunrise.

Venus.—Still a conspicuous object in the eastern morning sky at the beginning of the month, in the constellation of Pisces, rising 3 hours 25 minutes before the Sun and at the end of May, in the constellation of Aries, rising 3 hours 9 minutes before Sunrise.

Mars.—Now rising during the daylight hours and well up in the eastern sky by nightfall. On the 1st, in the constellation of Virgo, will set between 2 a.m. and 3.30 a.m., and at the end of the month will set an hour or two after midnight. About 11 p.m. on the 26th the Moon will pass in front of Mars.

Jupiter.—In the constellation of Capricornus, will rise about midnight during this month.

Saturn.—Not far from Mars and in the constellation of Leo. At the beginning of the month will set between 2.30 a.m. and 4 a.m., and at the end of the month will set between 1 a.m. and 2 a.m.



Star Chart.—The chart on the right is for 7.15 p.m. in the south-east corner of Queensland to 8.15 p.m. along the Northern Territory border on 15th May (for every degree of Longitude we go west the time increases by 4 minutes). The chart on the left is for 10 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing north hold "N" at the bottom; when facing south hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars, which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the Moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked the position is for the middle of the month.

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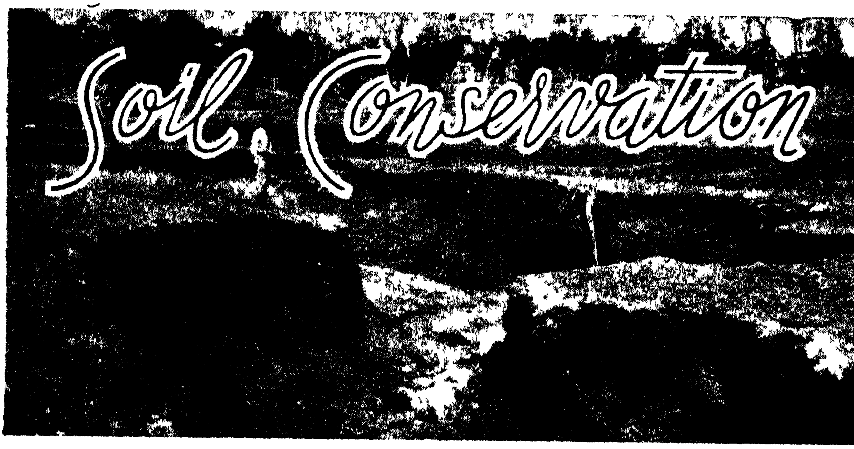
Contents



Soil Conservation in Queensland.

J E LADEWIG, Senior Soil Conservationist, and A F. SKINNER,
Soil Conservationist.

4. Water Disposal Systems.

THE adoption of soil conservation practices will usually reduce the wasteful loss of soil and water, but Queensland's heavy summer storms frequently yield more rain than can be absorbed by the soil, or otherwise stored or used. In order to dispose of the surplus run-off a carefully planned and protected drainage system becomes a necessity, but, since the efficient utilisation of rainfall is essential for maximum production from crops and pastures, water should be conserved to the greatest possible extent—firstly, by ensuring the maximum absorption of rain where it falls; secondly, by temporarily trapping it on the surface so that it can soak in later; and thirdly, by bulk storage in ponds or dams.

In the planning of works for the pondage or diversion of run-off it is necessary to ensure that a *stable well-grassed waterway* is available for the disposal of surplus water; it is equally important to design the works from the top of the immediate catchment, planning each work in succession, down the slope, so that control of run-off from the upper catchment is assured, before control on the lower catchment area is attempted.

Waterways.

Prior to settlement the surplus run-off water flowed into natural depressions, and since these were usually well covered with grass or trees, with the additional protection of ground litter, the water was safely transported to the main watercourses without serious drainage line erosion (Plate 121) occurring.

Following settlement, many of these drainage lines were ploughed or heavily grazed, the natural protection of vegetation disappeared, and huge gullies frequently developed. This is understandable when it

Plate 121.

Drainage Line Erosion.—This depression was once well grassed and quite stable, overstocking has contributed towards the development of the gully.

is realised that, whereas bare soil erodes under water velocities of 1 to 2 feet per second, good turf forming grasses so effectively protect the soil that velocities of up to 12 feet per second can be carried without erosion occurring, and even moderate natural pasture can withstand velocities of 4 feet per second.

In addition to the destruction of the protective plant cover on natural drainage lines, the volume and velocity of water carried by them has been greatly increased since settlement, by the clearing, burning, ploughing, and grazing of land in catchment areas

Where gullying has developed, the flow of run-off into that section of the catchment should be reduced to a minimum; on no account should additional run-off water be turned into an unstable gully unless special precautions have been taken. There is often a tendency to regard existing deep gullies as a satisfactory site for water disposal, but the waterfall created during rain, where the diversion structure enters the gully, inevitably induces the development of deep gullies along the channels of the water diversion structures (Plate 122).

Water Disposal on Natural Pasture.

Natural pasture may be utilised for the disposal of water from banks if the grass cover is good, and provided the velocity of flow does not exceed 4 feet per second; this method of disposal is therefore only utilised where small areas are being drained and only minor flows are anticipated. Water disposal on pasture has the effect of an irrigation

and the quality of limited areas of pasture can often be improved by this means. Where pasture is used as a disposal area, it must be carefully grazed and precautions taken to ensure that the water is spread widely.

Plate 122.

Water Disposal into Unstable Gullies.—The secondary gully, almost 4 ft. deep, developed in a few years where a contour bank discharged water into the main gully.

Well grassed depressions are occasionally available on farms for the disposal of water, but it is important to appreciate that the "ground cover" of grass is the essential feature of a good waterway; grasses which grow in tufts are not suitable because the run-off water is channelled into the bare areas surrounding the grass crowns, and erosion rapidly occurs.

Artificial Waterways.

Since natural well-grassed depressions are now a rarity in the agricultural areas of the State, it is usually necessary to provide a waterway, and establish a good grass cover on it, well in advance of projected bank construction operations. The construction and stabilisation of these waterways is one of the most important points in a soil conservation programme, and without the prior provision of this type of structure the subsequent programmes have little, if any, chance of being successful.

Since the velocity of flow is dependent largely on the depth of water, it is important that the water depth should be kept as shallow as possible by the construction of wide strips, which are level from side to side and slightly concave in the centre to the extent of 3 inches (Plate 123).

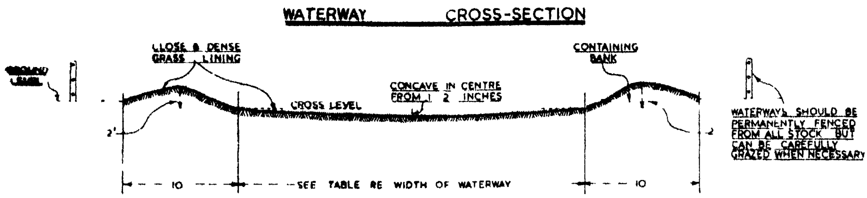


Plate 123

Sketch showing a typical waterway cross section.

The width of the waterway to be constructed will vary according to the area of land to be drained, and, since water velocity increases with degree of slope, greater widths of waterway per acre drained will be required on steep slopes.

Pending further research the following general rules apply:—

Where the land slope exceeds 8 per cent. (8 feet vertical rise or fall per 100 feet horizontal), but does not exceed 12 per cent., one foot of waterway width is allowed per half acre of arable land

Where the land slope is between 4 feet per 100 feet and 8 feet per 100 feet, one foot of waterway width is allowed per acre of arable land.

Where the land slope is between 2 per cent. and 4 per cent., one foot is allowed per 2 acres of land, and where the slope is less than 2 per cent., one foot is allowed per 4 acres of arable land.

Containing banks are constructed on both sides of the waterway, to a height of one to two feet, depending on the degree of slope, each with a bank base width of approximately 10 feet.

Since artificial waterways must be level in cross-section, much expensive grading work can be avoided by the careful selection of sites, ensuring where possible that the waterway follows the natural fall of the land; in this case the only requirement is the construction of the containing banks.

Where, in the interests of farm layout, it is desirable to construct a waterway adjacent to a fence line, additional grading work may be necessary to provide a level cross-section, and in this case may be justified. However, since waterways become a more permanent feature of the farm than fences, it is often preferable to ignore existing fence lines in order to provide the best waterway site; the task of re-fencing can be reduced by the use of a power driven post-hole auger.

The construction of waterways is a simple operation, but usually requires the use of a grader to move soil to build the containing banks, and to level out the centre section (Plate 124).

When construction work is completed the waterway area is cultivated to produce a fine seed-bed, and, since the establishment of vegetation is a most important consideration, the grasses to be used must be carefully selected to suit the soil type and local climatic conditions, preference being given to those that form a continuous turf. Kikuyu, couch, buffalo, paspalum and Rhodes grasses are the most satisfactory, though molasses and Wimmera rye grasses, and the legumes black medic and burr medic, have been used successfully where soil type and climate are favourable.

Plate 124.

An Artificial Waterway.—This waterway has been constructed with a grader, grasses sown, covered with a sorghum stubble mulch, and a temporary fence erected to exclude stock.

Plate 125.

Kikuyu Spreader Strip.—The line of straw, pegged down with netting, assists in controlling the water flow and facilitates the establishment of the kikuyu spreader strip.

It is preferable to sow a grass-legume mixture, and difficulties are occasionally encountered, particularly with light seeds such as Rhodes grass; a technique developed in the United States, utilising rice hulls as a regulator for planting grass mixtures through the grain drill, has given encouraging results.

Following the sowing of the seed mixture it is sound practice to establish "spreader strips" of kikuyu (Plate 125) or other suitable grass in level lines across the waterway at intervals of 50 feet. These strips assist in maintaining an even spread of water, and help to protect the waterway from scouring in the early stages before the other grasses provide the maximum protection.

As soon as possible after sowing operations have been completed it is usual to spread a layer of stubble or hay over the entire surface to a depth of one to two inches; this mulch layer protects the waterway against damage from heavy storms in the early stages, and by reducing evaporation assists the establishment of vegetation.

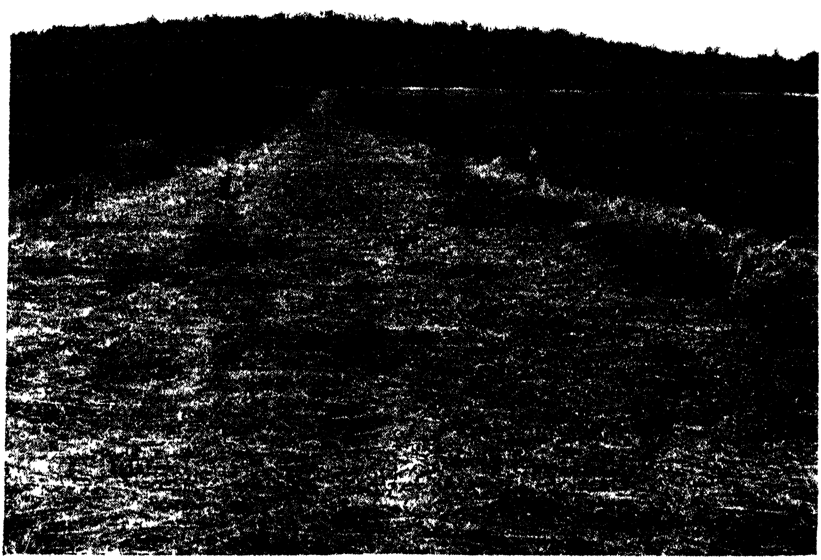


Plate 126.

A Completed Waterway.—Vegetation is well established and contour banks have been constructed. Photo. taken 12 months after construction.

All outside run-off must be excluded from the waterway until it is completely vegetated (Plate 126); under favourable conditions a waterway may be ready for use six months after construction, but where conditions for establishment of vegetation are unsatisfactory the period may extend to 12 months or more. It is essential that waterways be fenced to prevent access of stock during the period of establishment of vegetation, though at a later stage light grazing may be permitted, and in some circumstances it may be necessary to mow to remove surplus "top" vegetation.

Banana Plantation Management, with Particular Reference to the One Bunch—One Sucker—Straight Follow Through System.

J. H. MITCHELL, Assistant Adviser in Horticulture.

Bunches thrown between January and March are usually cut when prices are good, and banana growers, therefore, try to confine bunching to this period. Within the limits imposed by climatic factors, control of bunching and maximum production can be achieved under the "one bunch—one sucker—straight follow through" system of management. The keynote of success is control of the plantation from the time of its establishment. This calls for careful selection of planting material, accurate timing of planting, and strict adherence to some principles of de-suckering and follower selection which are peculiar to this system.

Apart from the special features of the system, the plantation must be properly laid out and handled, so that conditions are uniformly favourable for plant growth. Windbreaks should be established to reduce leaf splitting and root injury; adequate fertilizer should be applied at the appropriate times; weed growth must be continuously controlled; and where bananas are grown on steep slopes steps should be taken to prevent soil erosion.

PLANTING MATERIAL.

There are three forms of planting material used in establishing bananas—namely, corms, "bits" and suckers (Plate 127).

Corms.

The corm is the whole of the underground portion of the plant. The growing point and all but one of the eyes or buds are gouged out and the corm is then buried so that its junction with the pseudostem is approximately six inches below the surface of the ground.

Plate 127.

Banana Planting Material.—Left to right, bit, sucker, corm.

"Bits."

A "bit" is a portion of a corm with an eye or bud. Well-grown healthy plants at least six months old, but which have not yet bunched, provide a good source of "bits." The roots are trimmed from the plant after it is dug, a thin layer of the outer tissue removed as a precaution against beetle borer infestation, and the pseudostem cut off about four inches above the corm. On removing the outer ring of leaves the pink edges of the next pair will be seen to meet on the corm, and it is in this position that a small bud will be found (Plate 128);

Plate 128.

Bit Prepared for Planting (Weight 3½ lb.).—Note the effective bud.

a similar bud will be seen at the base of the next two leaves on the opposite side. These are the buds from which the new plant will arise. After they have been located the corm and attached pseudostem are split in half, so that each part possesses an eye, and placed in a shaded position for at least 24 hours to allow the cut surfaces to heal before planting. Prepared "bits" may vary from one to four pounds in weight.

The "bit" should be planted in an almost vertical position, generally with the eye facing in a south-easterly direction, and at a depth of about six inches In heavy soils shallower planting is permissible. "Bits" are given first priority as planting material

Suckers.

Suckers are the most widely used planting material, chiefly because they are easily obtained. Although a very good plantation can be established from suckers, this type of planting material has some disadvantages. When growth begins, a new corm is formed directly above the original and this habit brings the plant nearer to the surface (Plate 129). When the plantation is subjected to cyclonic winds, such plants have a tendency to collapse.

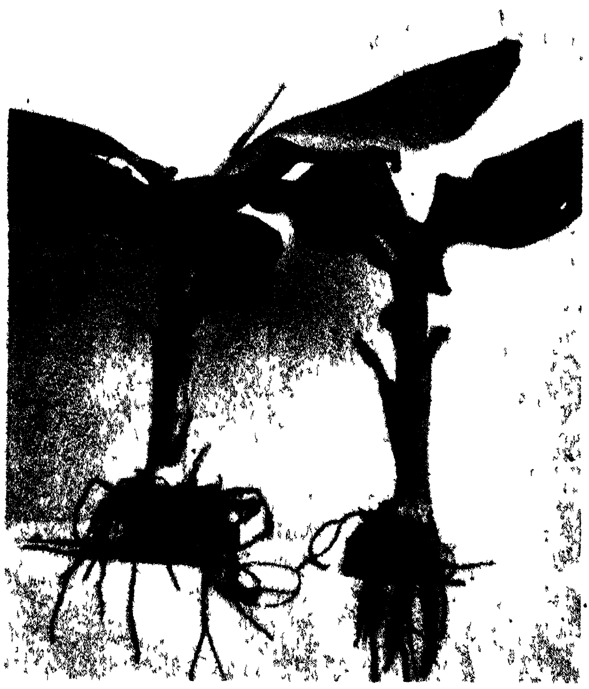


Plate 129

Left, Sucker Two Months Old.—Note formation of new corm above original sucker.
Right, A Bit Two Months Old.—Note unrestricted root development.

Suckers are planted with the junction of the corm and pseudostem approximately six inches below ground level. They should be placed

so that the part originally furthest from the parent plant faces in the direction desired in the first follower sucker, which in most cases is the south-east.

TIME OF PLANTING.

In a hot, moist, even climate the banana will bunch in about 12 months. On the near north coast, where cooler conditions prevail, the rate of growth is slow from April to September, and in a dry spring rapid growth may not occur until late in November. Under these conditions bananas will usually bunch 15 to 18 months after planting.

Seasonal conditions vary somewhat, but, in order to ensure bunching between January and March, Cavendish and Mons Marie varieties may be planted from mid-October to mid-December. Lady Fingers should be planted early in this period.

In order that control of bunching may be maintained, it is important that plant growth should not be checked. If for any reason the plants are backward, each stool may be given an additional application of two ounces of sulphate of ammonia each month, with a maximum of four applications. Satisfactory growth must be maintained by good cultural methods, particularly during the first six months, for it is in this period that the size of the future bunch is determined.

Plate 130.

Setting the Follower.—Maiden Plant Twelve Months Old with First Follower Set in November.

DE-SUCKERING.

As its name implies, this system demands the destruction of all suckers except a single follower, which is itself selected at the time and in the manner to be described later. Unwanted suckers develop at the expense of the parent plant. Up till the time when the first follower is set, all suckers must be destroyed soon after they appear above soil level. De-suckering each month is therefore essential, the approved practice being to cut off the sucker a few inches above the surface of the ground, gouge out a small central portion of the butt, and pour in about one-third of a teaspoonful of kerosene, or a little more in the case of larger suckers.

THE STRAIGHT FOLLOW THROUGH SUCKER.

The straight follow through sucker is that which arises more or less directly in line with the previous season's sucker and the parent plant. This sucker invariably originates from the base of the parent corm (Plate 131), and the new plant is thus firmly established in the soil and therefore less liable to damage by heavy winds.

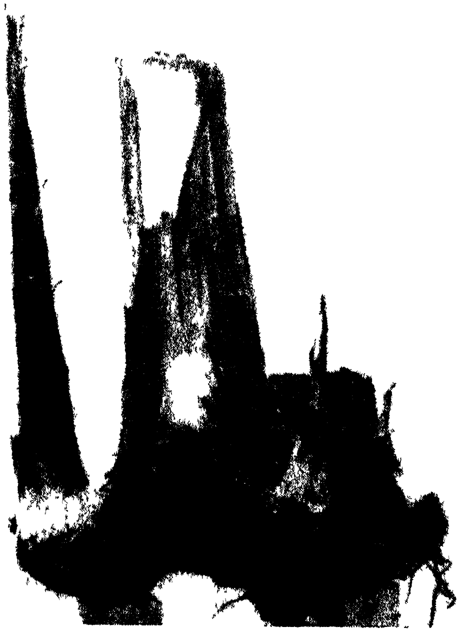


Plate 131.

The Straight Follow Through Sucker.—Maiden Plant at extreme right; first follower not yet bunched (cut for photographing) at centre; top sucker, referred to as a "sitter," at right centre. Note depth of straight follow through.

The straight follow through sucker usually appears when the parent plant is about three-quarters grown, and at a time when it is most desirable to set suckers for the next crop. Under normal conditions, selection of suckers for the second and subsequent ratoon crops is to a very large extent automatic if the first follower has been set at the right time.

SELECTING AND SETTING THE FIRST FOLLOWER.

The correct time at which to set the first follower will vary slightly from one plantation to another, but in all cases the first follower must be set before the parent plant bunches (Plate 130). Location, soil type, aspect and altitude will all influence the time taken for a plant to bunch, and will therefore govern the time for setting the first follower. Generally speaking, the best month for planting will be the best month to set the followers. The size of the parent plant is not taken into account; all followers are set at or about the same period so as to secure uniform bunching in the next ratoon crop. The system breaks down if this rule is ignored. The time at which the first follower is set to a large extent determines the success or otherwise of the plantation, for the behaviour of the crop in the third and subsequent years is governed by the management of the first ratoon crop.

Particular attention should be paid to the position of the first follower in relation to the parent plant. It should not be set directly up-hill, but rather across the slope, as nearly as possible in a south-easterly direction. As there is a tendency for the plant to throw its bunch on the sunny or northern side of the plant, interference with the follower by the developing bunch is reduced to a minimum. If a grower succeeds in getting his first ratoon crop to bunch from January to March, subsequent crops will fruit over much the same period each year.

Even if another system of sucker setting has been practised for the first ratoon crop, the straight follow through system may be applied from the third generation onwards by the elimination of all but the required sucker.

Plate 132.

Lady Finger Corm 29 Days from Planting with Two Suckers Growing from a Corm with the Centre Removed.

LADY FINGER.

The one bunch—one sucker—straight follow through system, though better known in Cavendish and Mons Marie varieties, is also applicable to the tall Lady Finger.

Normally suckers or whole corms, three to six months old, are used as planting material; the plant crop bunches are small, full production beginning with the first ratoon crop. A different practice used to initiate the one bunch—one sucker method of management has given better results on the near north coast. The corm is trimmed to two eyes on opposite sides and the centre of the corm gouged out at the time of planting. These two eyes develop into healthy plants in the one stool position and provide the plant crop (Plate 132).

Suckers from the plant crop are suppressed as in the dwarf and semi-dwarf varieties until the required sucker in the follow through position appears. Control is then imposed in the way already outlined.

ADVANTAGES OF THE SYSTEM.

The one bunch—one sucker—straight follow through system of banana plantation management was pioneered on the near north coast and has stood the test of long experience. It is the standard practice of good growers and appears to be a contributory factor to long productive life in the plantation, high yields and maximum financial returns. It is essentially a system of management for the man who values his land and aims to get the most out of it by efficient farming.

1950 SHOW DATES.

May.

Eidsvold	1 and 2
Roma	2, 3 and 4
Kingaroy	4, 5 and 6
Beaudesert	5 and 6
Inglewood	5 and 6
Wondai	11, 12 and 13
Marburg	12 and 13
Ipswich	16, 17 and 18
Blackall	16 and 17
Charleville	17 and 18
Biggenden	18 and 19
Murgon	18, 19 and 20
Thangool	19 and 20
Warrill View	20
Biloela	25 and 26
Gympie	25, 26 and 27
Crow's Nest	26 and 27
Kalbar	27

June.

Maryborough	1, 2 and 3
Wowan	1, 2 and 3
Boonah	2 and 3
Childers	5 and 6
Bundaberg	8, 9 and 10
Mt. Morgan	8, 9 and 10
Lowood	9, 10 and 12
Gin Gin	12 and 13
Gladstone	15, 16 and 17
Toogoolawah	16 and 17
Rockhampton	21, 22, 23 and 24
Kilcoy	23 and 24
Mackay	27, 28 and 29
Esk	30 and 1st July
Proserpine	30 and 1st July
Home Hill	30 and 1st July

July.

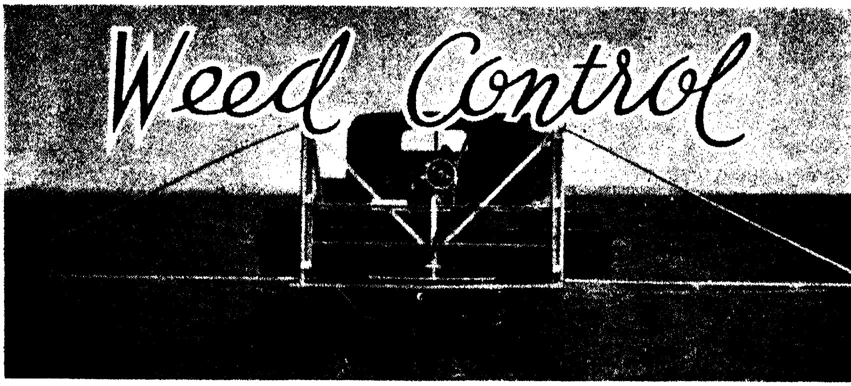
Bowen	5 and 6
Nambour	6, 7 and 8
Ayr	7 and 8
Laidley	7 and 8
Townsville	11, 12, and 13
Maleny	13 and 14
Ingham	14 and 15
Rosewood	14 and 15
Cairns	18, 19 and 20
Gatton	20, 21 and 22
Redlands	21 and 22
Tully	21 and 22
Woodford	21 and 22
Atherton	25 and 26
Innisfail	28 and 29
Lawnton	28 and 29

August.

Brisbane	5 to 12
Redcliffe	18 and 19

September.

Canungra	2
Beenleigh	15 and 16



Hormone Weedkillers and Their Use.

B. EASTERBROOK, Assistant to Weeds Officer, Science Branch.

THE discovery of the selective weedkilling properties of some growth-promoting substances used at relatively high concentrations compared with those occurring naturally was made during the early part of the war independently in England and in America. Since then these substances, generally known as "hormone" weedkillers, have become the most widely used of all selective weedkillers and are much to be preferred to other weedkillers for use in crops not affected by them. They are non-poisonous, non-corrosive, can be used successfully for high volume or low volume application and in most cases are much cheaper than other types of weedkillers.

It appears that in the soil hormones are oxidised and disappear after a period varying from about 30 to 90 days, depending upon the amount applied, the type of soil and its moisture and organic matter content, and the temperatures. Up to the present there is nothing to suggest that hormones will accumulate in the soil until they reach toxic proportions.

Hormones are not poisonous to man or animals even if taken in fairly large doses. Some people are allergic to them, although such cases are rare. Excessive contact with the skin has been known to cause slight blistering on a few occasions.

Mode of Entry and of Action.

It appears that hormones are absorbed by living surface cells on most parts of the plant. The breathing pores or stomata in the leaves are comparatively unimportant as a means of entry. Thick layers of dead cells, such as occur in old bark, greatly impede entry, but young, green stems readily absorb hormones. Ester formulations such as "Weedone" appear to be soluble in the cuticle, or waxy layer on the outside of the leaves, and hence penetrate tissues more rapidly.

Many plants absorb hormones readily through the roots, and it appears that when hormones are root-absorbed they are transported upwards to other parts of the plant in the transpiration stream, which is a stream of water passing from the roots to the leaves. If applied

to the leaves, hormones are transported downwards in the phloem, which is the tissue concerned with transporting the sugars and other carbohydrates manufactured in the leaves downwards to other parts of the plant.

Hormones are moved downwards from the leaves most readily when the translocation of sugar is most active and this usually occurs about the time the leaves have fully expanded. Very young, rapidly growing leaves have not made much carbohydrate and are still drawing upon the reserves stored in the roots, so that at this stage hormones are not usually rapidly transported down from the leaves. Similarly at the end of the growing season the mature leaves are ceasing to manufacture carbohydrates, so that downward translocation at this stage is not rapid.

Hormones appear to affect plants by interfering with one or other of the enzymes or inhibitors concerned with certain chemical reactions which are part of the growth process. Thus plants which are not growing are little, if at all, affected by ordinary concentrations; higher concentrations appears to have some action as contact poisons.

Characteristic effects of hormones are distorted growth, production of galls or roots on the stems and depletion of carbohydrate reserves; greatly increased rates of respiration have been observed. These effects are frequently followed by the death of the cells.

General Remarks on Use of Hormone Weedkillers.

From the above it is clear that the best time to spray plants with hormones is when there is active growth and maximum downward translocation of carbohydrates. These conditions can be best satisfied by spraying just before the plants are in full leaf, as growth is still active and the leaves are vigorously manufacturing carbohydrates. However, in practice this applies only to perennials which have a reserve of carbohydrates from the last season stored in underground organs. Annuals, or any seedling plants, have no such reserve and as soon as the food in the seed is exhausted the young leaves make food to send down to the growing roots. Consequently, seedlings in general are readily affected by hormones.

Hormones should be applied when the weather is calm and sunny and the temperature between 70 deg. F and 80 deg. F. Frosts and drought tend to check the growth of plants and make weeds more resistant to the action of hormones. Dust or water on the leaves tends to prevent adequate penetration and may seriously lessen the effect of the spray. Rain falling within a few hours of application is likely to wash off most of the spray if a water soluble type is used, and even oil-based sprays are likely to be affected to some extent. Hence, choosing a period of fine weather for spraying is important.

Generally speaking, water-soluble types are less effective against perennials than the oil-soluble esters but are very effective against a wide range of annuals and their selective action is more marked. The esters are not sufficiently selective to be used in any crops unless in very low concentrations and even then uneven coverage, where there has been overlapping of areas sprayed, may in places result in injury to the crop.

Spraying Weeds in Crops and Pastures.

In the following paragraphs are given recommendations for use of hormones in specific crops and in pastures. As little experimental work on spraying crops has been done in Queensland, most of these recommendations are taken from overseas reports. The effect of hormones on the particular varieties of crop plants grown and under particular local conditions may vary; therefore, in applying overseas results to Queensland conditions a conservative attitude has been adopted. Later work may cause the recommendation to be changed, but until such work has been done it is not advisable to depart widely from these recommendations when spraying on a large scale. The use of esters in growing crops is not recommended at present. Hormones are used for weedkilling in concentrations varying from about 0.025 per cent. for extremely susceptible species (such as weeds of the turnip family) up to 0·3 per cent. or 0·4 per cent. for more resistant species such as nut grass. For killing suckers and undergrowth strengths up to 2·0 per cent. are used.

Cereal Crops may be sprayed at rates of up to 1 lb. of active ingredient per acre after the crop plants are five or six inches high and before head formation has begun. In maize or sorghum no more than ½ lb. per acre should be applied, and the maize is less likely to be injured if sprayed when suffering from lack of moisture, though at such times the weeds also are more resistant. An application of 20 gallons per acre of a 0·1 per cent. solution is sufficient to kill bell vine and some other weeds of corn with little chance of crop damage. In many cases it is possible to apply as little as 15-16 gallons per acre in cereal crops by using boom sprays and at this rate of application 1 lb. of active constituent can be dissolved in 100 gallons of water, which will cover roughly six acres. This treatment has been found to give excellent results against turnip weed and other closely related species which are common in grain crops, and there is no danger of crop damage. However, black bindweed and European bindweed are not satisfactorily killed by so light an application.

Linseed.—If grown for seed only, linseed may be sprayed after it is four inches high and before flowering. Rates of application recommended by overseas workers as harmless to the crop vary from 1 lb. to 2 lb. per acre. The crop tolerance probably varies with the soil and climate and the varieties grown, so that until experiments are done in Queensland not more than 1 lb. per acre should be applied.

Potatoes.—It appears that hormones can be used for killing weeds in potatoes under certain conditions, but in the absence of any experimental work under Queensland conditions and with the varieties grown here, their use cannot be advised.

Sugar Cane.—The Bureau of Sugar Experiment Stations is conducting experiments with 2,4-D in cane crops and growers requiring information should contact officers of the Bureau direct.

Pastures.—These can be sprayed at rates up to 2 lb. per acre with salts or esters; esters may burn the leaves of grasses, particularly kikuyu, but are not likely to kill them, although bent grasses (*Agrostis* spp.) and buffalo grass have occasionally been killed. Most legumes are highly susceptible, so that the use of hormones in mixed pastures should be confined to the weed-infested patches. White clover is usually not killed completely unless several sprayings are carried out, but annual clovers are likely to be killed readily.

Susceptible Crops.—The following is a list of susceptible crops which should not be sprayed with hormones and which may be damaged by spray drift or volatilization of esters from adjoining areas or by applying insecticides or fungicides in equipment contaminated with hormones:—bananas, citrus, peas, tomatoes, beans, cotton, pineapples, turnips, beetroot, cabbage, cauliflower, carrots, clover, grapes, lucerne, parnsips, pumpkins, radish, stone and pip fruits, tobacco.

All flowers should be regarded as being highly susceptible.

Pre-emergence Treatment.

This can be classified into two types. In contact pre-emergence, the application of a light dose of spray is made shortly before the crop emerges, to control all weeds that emerge before the crop. Timing of application is very important, as the crop may be damaged if it emerges while there is still any spray residue in the soil.

In residual pre-emergence, the material is applied usually soon after planting and the chemical remains in the soil for some time, often long after the crop has appeared, so that selective action by the weed-killer is necessary. Hormones and some phenolic compounds are used for this type of treatment. It is really a selective soil sterilization and, where practicable, is preferable to contact pre-emergence as it controls weeds over a longer period. More work on pre-emergence treatments will have to be done under Queensland conditions before they can be recommended here. In many cases post-emergence treatment is either more desirable or just as effective.

It has also been found that treating of compost and manure with 2,4-D in a 0·01 per cent. solution prevented weed seeds present from germinating; beans and peas four weeks later germinated normally when treated with this manure. Grass seeds were more difficult to kill.

Combination of Hormones with Other Sprays.

Sodium salts and esters can be combined with several fungicides and fertilizers. Amine salts should not be used with sprays containing lime or metals such as copper, magnesium or iron, as precipitates which may block the nozzles are likely to occur. Very hard water may also cause troublesome precipitates to form, particularly with amine salts.

Removal of Hormone Residues from Spraying Equipment.

Where possible, equipment and containers should be used for hormones alone. If this is not possible, all equipment including tanks, hoses, nozzles, &c., must be thoroughly washed and, before being used for spraying insecticides or fungicides on crops susceptible to hormones, should be tested for any toxic residue by spraying water on a few young tomato plants or some other highly susceptible species. If there is no injury in three days, the equipment is clean; if there is injury, the washing must be repeated.

Where water soluble sprays have been used, wash the equipment three times with soapy water then fill with clean water to which household ammonia has been added at the rate of one quart to 25 gallons of water; allow the equipment to stand overnight and then wash out the ammonia. When esters are used, the equipment should first be rinsed out with kerosene and then washed as before; several washings may be necessary.

Sometimes instead of washing out with soapy water and then soaking overnight with ammonia, equipment is given two or three washings with washing soda followed by rinsing out with clean water.

Equipment.

For small areas knapsack sprays are suitable; the chief disadvantage with these is the large amount of refilling that is necessary, as most knapsacks have a capacity of about 3½ gallons. The use of low-volume nozzles will help to overcome this difficulty.

For spraying extensive, even areas boom sprays are used. The commonest type at present being used, particularly for spraying crops, consists of a 20 foot or 40 foot boom fitted with nozzles with an aperture of $\frac{3}{64}$ inch, delivering a fan shaped spray; the nozzles are spaced about 22 inches apart. The pump develops an effective pressure of about 15 lb. per sq. in. with a 40 foot boom and about 20 lb. per sq. in. with a 20 foot boom.

It is very important to adjust the position of the boom to the correct height above the weeds to give an even cover. Two heights are used, the lower height giving what is termed uniform single coverage, the greater height giving uniform double coverage; the latter does not involve the use of any more spray but gives the most even cover it is possible to get. However, it has the disadvantage of requiring the boom to be placed exactly twice as high as for uniform single coverage. With nozzles 22 inches apart and an aperture of $\frac{3}{64}$ inch, the correct height for uniform single cover at 15 lb. per sq. in. is approximately 19 inches and at 20 lb. per sq. in. is approximately 17 inches. To give an application of 15 gallons per acre the speed of the vehicle needs to be roughly 4½ m.p.h. at 20 lb. pressure and 4 m.p.h. at 15 lb. pressure.

For rough country sometimes short booms are mounted on a tractor and hoses fitted to the booms, the nozzles being fitted to the free ends of the hoses. Men walking behind the tractor then manipulate the hoses. This method is of no use for spraying crops but should be of value in spraying weeds such as lantana in uneven country. A pump capable of developing high pressure is necessary, as there is often a considerable loss of pressure along the hose, particularly if long hoses are used. A suitable outfit needs a pump developing pressures up to 250 or 300 lb. per sq. in. The hoses should be fairly long and be fitted preferably with twin nozzles, as a greater area can then be covered by each hose. For this type of work, nozzles delivering a cone-shaped spray are better than those delivering a fan-shaped spray.

The application of hormones by aeroplane and by fogging machines is still in the experimental stage in Australia.

Classification of Hormone Weedkillers.

All the brands at present on the market are derivatives of phenoxyacetic acid; it has been found that the effectiveness of this acid is greatly increased by the substitution of chlorine atoms in certain positions on the benzene ring which forms the basis of the acid molecule, and the various brands may be classified according to the particular substituted acid from which they are formulated. The following list includes all the brands at present marketed in Queensland, together with some others shortly to become available. Prices may vary from time to time and those given are current at the time of writing.

2-Methyl, 4-Chlorophenoxyacetic Acid.

The sodium salt of this acid is marketed in Australia as Methoxone, a 10 per cent. water solution without wetting or spreading agents, and is used largely against annuals in cereal crops and other annuals such as Noogoora burr and mint weed. Methoxone is sold by the Lands Department for killing Noogoora and Bathurst burrs, mint weed and weir vine at 11s. 3d. per gallon, rail free to the nearest station. It is also obtainable from A.C.F. & Shirleys Fertilizers Ltd., Little Roma Street, Brisbane, at the following prices:—3s. 9d. per pint; 18s. 5d. per gallon; £3 7s. 4d. per 4-gallon drum; £33 per 44-gallon drum.

2,4-Dichlorophenoxyacetic Acid.

The various formulations of this acid are all known as 2,4-D. There are two main types: (*a*) sodium and amine salts, which are water-soluble, and (*b*) esters, which are insoluble in water but soluble in oils.

(*a*) Sodium and amine salts are sold as powders or in solution. All are readily water-soluble and most of the brands have wetting and spreading agents included. The sodium salts are similar to Methoxone but with a slightly greater range of susceptible weeds. The amine salts are rather more effective against perennials, being intermediate in properties between the sodium salts and the more powerful esters, but are quite suitable for use in the specified crops. The following are the brands of sodium and amine salts at present available. For most of these the price works out at roughly £1 per lb. of active constituent. Actual brands differ widely in price per pound and per gallon because they differ widely in the amount of active constituent present.

United Selective Hormone Weedkiller.—50 per cent. solution; obtainable from Lands Department for Noogoora and Bathurst burrs, mint weed and weir vine at 58s. per gallon rail free. Also sold by United Chemicals Pty. Ltd., Montague Road, South Brisbane.

2,4-Diweed:—70 per cent. powder; H. Blaiklock & Co., 1078 Ann Street, Valley, Brisbane:—

	s.	d.
½ lb.	12	0
1 lb.	20	5
14 lb.	19	6 a lb.
28 lb.	19	0 a lb.

Hardy's 2,4-D: 77 per cent. powder. Brett & Co., Grey Street, South Brisbane:—

	s.	d.
16 oz.	12	6
35 lb.	10	6 a lb.

Vallo 2,4-D: 82 per cent. powder; A. Victor Leggo & Co., Mary Street, Brisbane:—

	s.	d.
4 oz.	6	0
8 oz.	10	9
1 lb.	19	6
5 lb.	17	3 a lb.
25 lb.	16	6 a lb.

Dartormone: 80 per cent. powder; International Traders, 228 Roma Street, Brisbane:—

	s.	d.	
4 oz.	6	0	
1 lb.	18	6	
5 lb.	17	3	a lb.
1 cwt.	15	9	a lb.

Chloroxone: 80 per cent. powder; A.C.F. & Shirleys Fertilizers Ltd.:—

56 lb. drums only at 11s. per lb.

Taubman's No. 6 Weedkiller: 81 per cent. powder. Taubman's (Qld.) Pty. Ltd., 95 Edward Street, Brisbane:—

	s.	d.	
1 lb.	20	0	
7 lb.	16	6	a lb.
28 lb.	12	8	a lb.

Hormex: 50 per cent. liquid (amine salt); Lands Department for Noogoora and Bathurst burrs, mint weed and weir vine at £3 a gallon, rail free.

Also from Wilcox Mofflin Ltd., Barry Parade, Brisbane:—

	£	s.	d.	
8 oz.	0	6	10	
½ gallon	3	2	8	
1 gallon	5	14	0	
4 gallons	4	13	9	a gallon

Weed-all: 50 per cent. liquid (amine salt). Pope, Mayne, and Southerden Pty. Ltd., 300 Adelaide Street, Brisbane:—

	£	s.	d.
1 gallon	4	15	0
4 gallons	18	0	0

Weedar: 41 per cent. liquid (amine salt); A. G. Bignold & Co., 169 Elizabeth Street, Brisbane:—

Approximately £5 5s. per gallon.

(*b*) Esters: These are insoluble in water but are sold in an oil solution which can be readily emulsified with water; they are volatile compounds and sufficient may evaporate in warm weather to cause damage to susceptible plants growing alongside areas sprayed with them. They are not recommended at present for spraying crops but are useful for killing perennial and shrubby weeds in pastures, waste areas, roadsides, and other places where marked selective action is not desired. They may burn leaves of grasses, but do not kill the runners. The ethyl ester is at present sold in two forms:—Weedust, a powder mainly for use in lawns; and Weedone 57, a 35·2 per cent. oil solution with emulsifiers added. Both are sold by A. G. Bignold & Co., 169 Elizabeth Street, Brisbane. The price of Weedone 57 is £5 15s. a gallon.

2,4,5-Trichlorophenoxyacetic Acid.

Several formulations of this acid will soon be available. In general, 2,4,5-T is less effective than 2,4-D on annuals and some perennials such as water hyacinth and nut grass, but is markedly more effective on

woody shrubs. It has been found very effective against members of the rose family, such as blackberry, briar and wild raspberry, and in experimental work shows great promise against eucalypt suckers, tea-tree suckers and others.

Weedone Special 2,4,5-T:—35·2 per cent. ester in emulsifiable oil solution. A. G. Bignold & Co., 169 Elizabeth Street, Brisbane. The price is approximately £7 18s. 6d. a gallon.

A combination of 2,4-D and 2,4,5-T esters in an emulsifiable oil will soon be available. This has been found to be effective against a large number of shrubs and trees in America. Both this and 2,4,5-T appear to be promising as non-toxic alternatives to arsenic for killing many trees and suckers in dairying and pastoral country. Results so far indicate that oil or kerosene solutions are more effective than water emulsions for swabbing and frill poisoning, but any greater effectiveness must be measured against increased costs.

The following brands of this combination will soon be available:—

Weedone Brushkiller 32: 34 per cent. in an emulsifiable oil; A. G. Bignold & Co., 169 Elizabeth Street, Brisbane.

2,4,5-T plus: 40 per cent in emulsifiable oil. International Traders Ltd., 228 Roma Street, Brisbane:—

	£	s.	d.
3 oz.	0	5	9
1 pint	1	13	9
1 quart	2	6	3
½ gallon	3	19	6
1 gallon	6	4	6

Trimex: 40 per cent. in emulsifiable oil: Wilcox Moffin Ltd. Sold in 8 oz., 1 gallon and 5 gallon tins at roughly £6 8s. 3d. per gallon.

Diweed 5-T: 40 per cent. in emulsifiable oil; H. Blaiklock & Co.:—

	£	s.	d.
1 pint	1	1	0
1 quart	1	17	6
½ gallon	3	10	0
1 gallon	6	5	0

Taubman's No. 11 Weedkiller: 40 per cent. in emulsifiable oil; Taubman's (Qld.) Pty. Ltd., Edward Street, Brisbane:—

	£	s.	d.	
1 pint	1	1	0	
1 quart	1	17	6	
1 gallon	6	5	0	
4 gallons	6	0	0	per gallon

Carbamates.

It is of interest to note that certain other organic chemicals known as carbamates affect the growth of grasses but not of broad-leaved weeds. The most active of these, isopropyl-phenylcarbamate, stopped the growth of cereals at a concentration which did not affect marigold, sugar beet, flax, rape and charlock. However, no practical use of carbamates has been made yet.

Susceptible and Resistant Weeds.

The following lists are to a great extent provisional and further testing may alter the positions of various weeds as well as adding new weeds. If a weed has, up to the present, been killed satisfactorily with only one type of hormone, the name of that hormone is given after the name of the weed. Weeds marked with a star have been killed either in small scale tests only or in other States but not in Queensland and should therefore not be sprayed on a large scale unless a small patch is first sprayed to test the effectiveness of the hormone under the conditions existing in the particular area. Plants such as wild tobacco, with very hairy or velvety leaves, need a spray with a highly efficient wetting and spreading agent.

The minimum amount necessary to apply to get a satisfactory kill is expressed in pounds of active constituent per acre. Often when spraying small areas it is more convenient to think in terms of the concentration to be used rather than in terms of the number of pounds which must be applied per acre. In these lists it may be taken that 1 lb. per acre requires a 0·1 per cent. solution, 2 lb. per acre a 0·2 per cent. solution and so on, where the rate of application is sufficient to give a good cover of all leaves.

A 0·1 per cent. solution applied at the rate of 100 gallons per acre gives an application of 1 lb. per acre, at 200 gallons per acre 2 lb. per acre and so on. If it is necessary to apply 1 lb. per acre and the equipment being used applies the solution at the rate of 20 gallons per acre, a 0·5 per cent. solution must be used.

The concentration of all hormone weedkillers on the market is expressed as the percentage of active ingredient contained per gallon in the case of liquids and per lb. in the case of powders. For powders, a 0·1 per cent. solution is obtained by dissolving 1 lb. of the powder in 80 gallons of water if the powder contains 80 per cent. active constituent; if it contains 70 per cent. active ingredient 1 lb. should be dissolved in 70 gallons, and so on. If a 0·2 per cent. solution is required only half as much water as for a 0·1 per cent. solution should be used, for a 0·5 per cent. solution one-fifth as much. For liquids, a 0·1 per cent. solution is obtained by mixing 1 part with 100 parts of water if the liquid is 10 per cent., 1 part with 360 parts of water if it is 36 per cent., and so on. Again, for a 0·2 per cent. solution the amount of water added should be half that added for a 0·1 per cent. solution.

Annuals and Biennials.

Highly susceptible if sprayed under the right conditions.	lb. per acre.
Asthma plant (*Euphorbia hirta*)	1
Barbwire weed (*Nyssanthes diffusa*)	2
Bathurst burr (*Xanthium spinosum*)	1
Bell vine (*Ipomoea plebeia*)	¼
Blue top or billygoat weed (*Ageratum conyzoides*) ..	1
Bull-head or cat-head (*Tribulus terrestris*)	1
Burr medic (*Medicago denticulata*)	1
Charlock (*Sinapis arvensis*)*	¼
Chickweed (*Stellaria media*)*	2
Cobbler's pegs (*Bidens pilosa*)	1
Crowfoot (*Erodium cygnorum*)*	2
Dead nettle (*Lamium amplexicaule*)	1

	lb. per acre.
Devil's claw (*Martynia louisiana*)	1
Fennel (*Foeniculum vulgare*)	2
Hedge mustard (*Sisymbrium officinale*)*	¼
Hexham scent (*Melilotus indica*)	1
Horehound (*Marrubium vulgare*)	1
Jojo weed (*Soliva sessilis*)	2
Mallow (*Malva parviflora*)	2
Milk thistle (*Sonchus oleraceus*)	1
Milkweed (*Euphorbia drummondii*)	1
Mint weed (*Salvia reflexa*)	1
Noogoora burr (*Xanthium pungens*)	1
Oriental rocket (*Sisymbrium orientale*)	¼
Petty spurge (*Euphorbia peplus*)*	2
Pigweed (*Portulaca oleracea*)	1
Prickly lettuce (*Lactuca scariola*)	2
Ragweeds (*Erigeron canadensis and E. linifolius*)	2
Red caustic creeper (*Euphorbia prostrata*)	2
Scotch thistle (*Cirsium lanceolatum*)	2
Shepherd's purse (*Capsella bursa-pastoris*)	1
Slender thistle (*Carduus tenuiflorus*)*	2
Stagger weed (*Stachys arvensis*)	1
Star burr (*Acanthospermum hispidum*)	1
Stinking roger (*Tagetes minuta*)	1
Texas sage or wild Salvia (*Salvia coccinea*)	1
Turnip weed (*Rapistrum rugosum*)	⅙
Wild hop (*Nicandra physaloides*)	2
Wild radish (*Raphanus raphanistrum*)	⅙
Wild turnip or mustard weed (*Brassica spp.*)*	¼
Yellow weed (*Galinsoga parviflora*)	1

Susceptible in young stages; older plants very variable.

Black nightshade (*Solanum nigrum*)*	2
Canada thistle (*Cirsium arvense*)*	2
Chicory (*Cichorium intybus*)	2
Cockspur thistle (*Centaurea melitensis*)*	2
Fat hen (*Chenopodium album*)	2
Fish weed (*Chenopodium triangulare*)	2
Fumitory (*Fumaria parviflora*)*	2
Panicled amaranth (*Amaranthus paniculatus*)*	2
Mexican or prickly poppy (*Argemone mexicana*)*	2
Saffron thistle (*Carthamus lanatus*)	2
Spiny emex or double gee (*Emex australis*)	2
Star thistle (*Centaurea calcitrapa*)	2
St. Barnaby's thistle (*Centaurea solstitialis*)*	2
Variegated thistle (*Silybum marianum*)	2
Wireweed (*Polygonum aviculare*)	2

Perennials.

A great many perennials require more than one spraying to eradicate them completely; later sprayings often have to deal with no more than isolated patches.

Highly susceptible under suitable conditions.	lb. per acre.
Bindweed (*Convolvulus arvensis*)	2
Black roly poly (*Bassia quinquecuspis*)*	2
Blackberry (*Rubus fruticosus*)* 2,4,5-T.	3½
Brigalow burr (*Bassia tetracuspis*).* Not Methoxone	2
Bryophyllum (*Bryophyllum calycinum*)	1
Carrot weed (*Daucus glochidiatus*)	1
Castor oil plant (*Ricinus communis*)	1
Common verbena (*Verbena officinalis*)	1
Common dock (*Rumex brownii*)	2
Curly dock (*Rumex crispus*)	2
Devil's apple (*Solanum sodomacum*)	2
Dodder (*Cuscuta australis*)	2
Duckweed (*Lemna oligorrhiza*)	1
Flannel weed (*Sida cordifolia*)	2
Flat weed or dandelion (*Hypochaeris radicata*)	1
Fern-leafed verbena or Mayne's Pest (*Verbena tenera*). 2,4,5-T	2
Galvanised burr (*Bassia birchii*), 2,4,5-T	2
Gomphrena weed (*Gomphrena celosioides*)	2
Guava (*Psidium guajava*)*	2
Hemlock (*Conium maculatum*)	2
Hoary cress (*Lepidium draba*)	2
Indian weed (*Siegsbeckia orientalis*)	2
Inkweed (*Phytolacca octandra*)	2
Lantana (*Lantana camara and L. montevidensis*)	2
Mexican clover (*Richardia brasiliensis*)	1
Morning glory (*Ipomoea purpurea*)	1
Mullumbimby couch (*Kyllinga monocephala*)	2
Needle burr (*Amaranthus spinosus*)	2
Paterson's curse (*Echium platagineum*)	2
Pennyroyal (*Mentha satureioides*)	2
Pennywort (*Hydrocotyle asiatica* and *H. laxiflora*)	1
Pepperwort (*Lepidium hyssopifolium*)	2
Pink-flowered Chinese burr (*Urena lobata*)	2
Plantains (*Plantago* spp.)	1
Poinsettia (*Euphorbia heterophylla*)	2
Spear-leaved fishweed (*Rhagodia hastata*)*	2
Star of Bethlehem (*Ipomoea quamoclit*)	2
Streaked rattlepod (*Crotalaria striata*)	2
Swinecress (*Coronopus didymus*)	2
Tree of Heaven (*Ailanthus glandulosus*)*	2
Veined verbena (*Verbena rigida*), 2,4,5-T	2
Wandering Jew (*Commelina cyanea*)	2
Water hyacinth (*Eichhornia crassipes*), 2,4-D sprays only	2
Weir vine (*Ipomoea calobra*)	1
White clover (*Trifolium repens*)	2
Susceptible in early stages; older plants very variable.	
Creeping knapweed (*Centaurea repens*)*	2
Galvanised burr (*Bassia birchii*)*. Weedone	4
Khaki weed (*Alternanthera repens*)	2
Lesser joyweed (*Alternanthera denticulata*)*	2
Onion weed (*Asphodelus fistulosus*)*	2
Purple top (*Verbena bonariensis*)	2

Susceptible in seedling stages only.	lb. per acre.
Sida retusa or Paddy's lucerne (*Sida rhombifolia*) ..	2
False mallow (*Malvastrum coromandelinum*)	2

Plants which are susceptible in early stages, older plants requiring brushing and the regrowth to be sprayed.

Devil's Fig (*Solanum torvum*)*	2
Groundsel bush (*Baccharis halimifolia*)	2
Wild tobacco (*Solanum auriculatum*)*	2
Wild verbena (*Heliotropium amplexicaule*)*. 2,4,5-T	2

Plants which require to be cut off and the butts swabbed.

It appears that suckers and young plants of numerous species of *Eucalyptus, Casuarina, Leptospermum* and others may be satisfactorily killed by cutting off near ground level and swabbing with a 1 per cent. solution of 2,4,5-T. However, this work is still in the experimental stage and large scale operations should not be carried out until results of the trials are definite.

Species very variable in susceptibility at all stages of growth.

Black pig weed (*Trianthema portulacastrum*).
Common thorn apple or stramonium (*Datura stramonium*).
Green amaranth (*Amaranthus viridis*).
Mist flower (*Eupatorium riparium*).
Sensitive plant (*Mimosa pudica*).
Tick trefoil (*Desmodium triflorum*).
Waterpepper (*Polygonum hydropiper*).

Species resistant for practical purposes.

Black bindweed (*Polygonum convolvulus*).
Bracken fern (*Pteridium aquilinum*).
Bullrush (*Typha* sp.).
Cape gooseberry (*Physalis peruviana*).
Green cestrum (*Cestrum parqui*).
Ground cherries (*Physalis* spp.).
Long-spined thorn apple (*Datura ferox*).
Lilac-flowered oxalis or shamrock (*Oxalis corymbosa*).
Milky cotton bush (*Asclepias fruticosa*).
Redheaded cotton bush (*Asclepias curassavica*).
Rushes (*Juncus* spp.).
Yellow oxalis (*Oxalis corniculata*).
All true grasses except bent grass (*Agrostis* sp.) and buffalo grass.

Special Weeds.

Nut grass (*Cyperus rotundus*): Shoots and the tubers from which they rise are killed by liberal application of 0·2 per cent. solution. Dormant tubers can be killed by later sprayings when they have germinated; very deep tubers are not killed but may be starved by repeatedly spraying shoots arising from them.

Crofton weed (*Eupatorium adenophorum*): If brushed and the regrowth sprayed it is killed by liberal application of 0·4 per cent. 2,4,5-T or 2,4-D plus 2,4,5-T.

Lantana (*Lantana camara*): Young bushes or regrowth are readily killed by 2,4-D sprays in a 0·2 per cent. solution provided that the plants are actively growing when sprayed and that all the leaves and young stems are covered thoroughly with spray. 2,4,5-T appears to give best results of all, particularly on larger bushes.

Mechanisation of the Cheese Industry.

W. A. G. HAYLETT, Senior Adviser in Dairying.

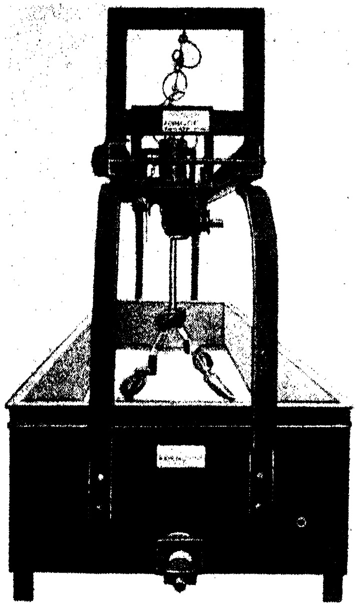
DURING a recent visit to Victoria, the opportunity was taken by the writer to observe some of the developments which have taken place in the mechanisation of the cheese industry of that State in recent years. By this means much progress has been made in meeting the changing situation in manufacture brought about by the dearth of skilled labour and the shorter working week. Prior to the advent of these improvements in cheese manufacture, there was a tendency to use "hurry up" methods with the ordinary type of equipment; this was detrimental to quality in a fermentation process such as cheese-making. The developments referred to herein have enabled a reduction in the amount of unskilled labour in the factory, have reduced manufacturing cost by avoiding overtime payments for employees, and at the same time have led to an improvement in the body and texture of the cheese.

Starter Control.

Modern methods of starter control were described in this Journal for April, 1949. In Victoria considerable headway has been made in adopting improved methods of starter control along the lines referred to in the abovementioned article by the use of water-sealed bulk starter-can lids and the technique of single-strain propagation. This has done much to overcome "slow" vats, reduce overtime and improve cheese quality.

Travelling Motor Agitator and Curd Stirrer.

The introduction of the mechanical curd stirrer to replace the wooden rake was a notable advance in the cheese industry of some years ago, and most Queensland factories now have these mechanical agitators. The electrically-driven motor travelling agitator and curd-stirring device now used in some factories in Victoria is a further development. As well as stirring the curd in the whey, it can be used for stirring the curd after the whey has been run off and after milling.



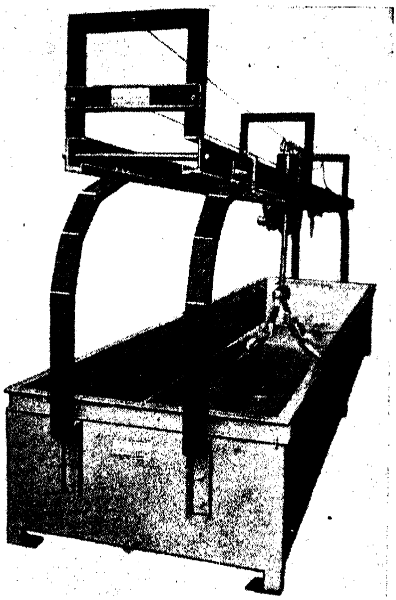


Plate 133.
Two Views of Travelling Agitator and Curd Stirrer.

The travelling agitator and curd stirrer consists of a pair of metal paddles driven by a 1 h.p. motor which travels backwards and forwards from end to end of the vat on overhead rails fitted to both ends (Plate 133). The motor can be controlled by an accessible push-button switch. The paddles, which are screwed to arms fitted to a block just above the level of the top of the vat, rotate in a clockwise direction and efficiently stir the milk or the curd. The machine, which has two speeds, takes approximately 40 seconds in top gear and 80 seconds in bottom gear, to travel the length of a 1,000 gallon vat. A trip-gear automatically changes the direction of movement by throwing the patent drive clutch from one winding drum to the other by means of tension on either of the $\frac{3}{8}$ inch flexible steel cables. The overhead gear is made from channel iron or from three galvanised iron pipes set apart like the three points of a triangle to enable the convex wheels to run on two pipes whilst the third supports a metal strap to avoid displacement.

The paddles are like plough shears, measuring 4 inches across at the widest part and tapering to the toe. The paddles can be geared into any of three speeds, varying from 6 to 14 revolutions per minute. By adjusting the hinges holding the paddles to the two arms, the paddles can be set at convenient heights for stirring (*a*) milk in the vat, (*b*) curd in the whey stage, and (*c*) the curd after wheying off and milling. To avoid wear of the vat or the paddles, when dry stirring the curd a plastic or rubber shoe is fixed to the paddles.

When milk is being added to the vat and "ripened" by the starter the agitators can be set in motion in high or low gear. When the vat is ready for setting, the paddles and arms attached to the block are removed. After the curd is cut, the paddles are refitted, and the

agitators set in low gear. At first the resistance of the freshly cut curd is noticeable, but it is only a matter of a few minutes before the soft curd is moving freely, and it is surprising how the action of the agitators frees the curd from the corners of the vat. The cheesemaker is thus saved from stirring the vat by hand and the gentle, but thorough, action of the paddles does not bruise the soft pieces of curd. In contrast with standard agitators, it is unnecessary to remove by hand curd which collects in the corners of the vat. Although the vat of curd may appear a little lumpy, this is not detrimental.

When the vat is ready for "wheying-off," the agitators are stopped, but not removed from the block, as when setting the vat. If it is necessary to "dry-stir" the curd after running off the whey, the paddles are set lower and closer to the bottom of the vat and the action of the paddles in top gear, breaking up the matting curd particles and quickly draining off the whey, assists to dry out and firm the curd. At this stage the agitators are capable of handling the curd from another cheese vat, and from then on the curd from two vats is combined in one vat and handled by mechanical agitation. In "doubled" vats the whey from two vats (set at the same time) is run down at approximately 0·15 per cent. acidity and the remaining whey and curd pumped over from one vat to the other by means of a portable 2-inch centrifugal pump. This allows the second vat to be washed and refilled in 1½-2 hours.

The agitators and motor are left stationary in one end of the vat when the curd is being cheddared. During milling, the agitators are again put into use, the manipulation of the trip gear enabling their return over the milled curd while the curd mill is still operating. This prevents the early matting of the curd pieces and allows for early aeration of the curd.

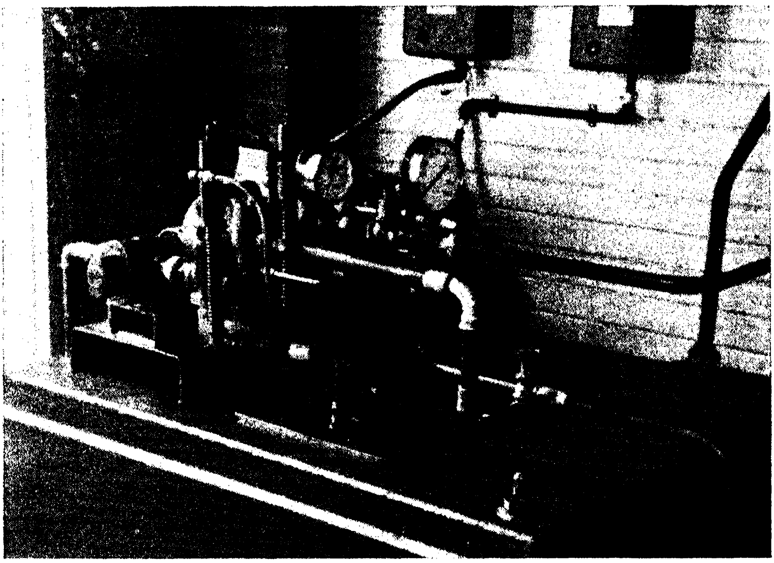
After milling, the machine-stirring enables the curd to be handled by one operator, or, if there are several vats, one cheesemaker can salt without any assistance. At this stage, machine-stirring is more effective than hand-stirring, which is one of the heaviest and most fatiguing jobs in a cheese factory. Another advantage is that salting can be done in several light applications, and the salt thoroughly and evenly incorporated. At the same time, the curd is sufficiently disturbed to prevent it from matting, and sufficient time is allowed for it to mellow. This is beneficial to the body and texture of the cheese. The mechanical stirring of the curd during salting is also more hygienic than manual stirring. The only disadvantage appears to be that excessive stirring of the curd has a tendency to dry it out too much, which causes a hard, corky body. If the speed is reduced and the curd handled carefully, this defect can be obviated.

The cost of the equipment is approximately £400 per unit. The weight of the unit is about 3 cwt.; and when channel iron is used for the overhead gear it weighs about 10 cwt. By the use of a triangular set of galvanised iron piping, strapped to prevent spreading, the overhead weight would be considerably reduced in comparison with the channel iron, which is difficult to procure. Moreover, the galvanised iron piping would increase the strength and rigidity for the travelling of the convex wheels. This overhead piping could be fitted to the usual vats in use in Queensland, by suspending it from the factory rafters or fitting it to the ends of the vat, so that the tipping of the vat would not affect its use (Plate 133.) The 1 h.p. electric motor could be driven by power generated by the diesel engine commonly found in Queensland cheese factories.

Taking into consideration the advantages mentioned and the saving of wages of one unskilled labourer, the cost of the equipment is economically justified.

Hydraulic Cheese Press.

The hydraulic cheese press overcomes the heavy manual work associated with the standard cheese press and saves time at the close of the day when the factory staff are tired. The higher and continuous pressure gives a close-textured cheese. It is also likely that export-size cheeses could be pressed for one instead of two days.



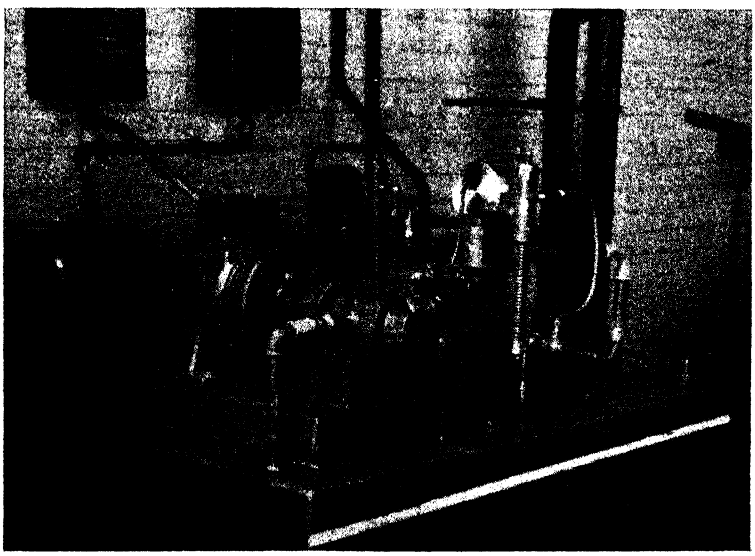


Plate 134.

Two Views of Pump Unit for Hydraulic Cheese Press.

Hydraulic equipment for operating cheese presses consists of an electrically driven pump unit (which is duplicated for emergency purposes) mounted on an oil sump of a capacity suitable for the number of presses (Plate 134). The oil under pressure is piped to the cylinder unit which is mounted on the end of each press. The movement of the ram in each cylinder unit is controlled by one lever for forward, neutral and reverse. When left in the forward position it automatically presses the tube to any pre-determined pressure up to 10 tons and maintains this pressure so long as the pump unit is running (Plate 135).

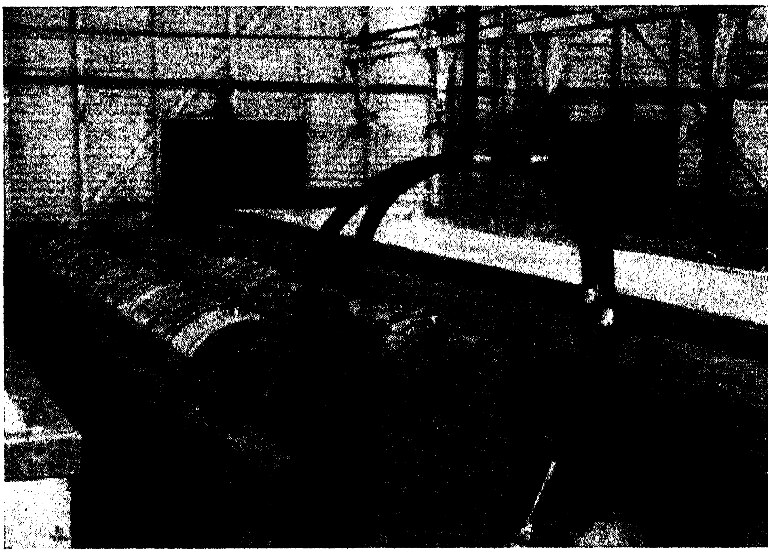


Plate 135.
Two Views of Hydraulic Cheese Press.

Should any trouble occur with the electric motor, switch gear, pump valve, &c., the stand-by unit can be instantly put into operation by the closing of a separate switch. The pump unit is equipped with an unloading valve, which increases the life of the motor, pumps and valve considerably and uses less electric power. All weights, levers and screws are dispensed with and more cheeses can be placed in the press at once. As many as 17 export-size cheeses (80 lb. each) have been placed in the press at once, compared with 13 in the ordinary gang press. To manage the extra number of cheeses to a press, it is necessary to take up pressure and, on reversing the gear, add additional hoops.

To enable the ordinary cheese press frames to withstand the higher pressure used for hydraulic pressing, it is necessary to increase the strength of the press frames. It has been found from experience that the addition of two extra sets of legs to a standard cheese press frame strengthens it quite appreciably and presses so reinforced have withstood pressure of up to 11 tons for quite long periods without adverse effect. This equipment could be installed by the average engineer. It entails the following work:—

(*a*) The placing of the pump unit in a suitable position relatively close to the cheese presses, but preferably in an adjoining room so as to protect the plant from moisture, steam and salt.

(*b*) The running of a pressure and return pipe line of ¾-inch steam piping from pump unit to cylinder unit, keeping the vertical head of hydraulic fluid as low as possible.

(*c*) The connecting of 415 volt three-phase electricity supply, including suitable fuses and switch gear; alternatively, a 2 h.p. generator driven by a diesel engine as found in most Queensland factories would suffice to drive this equipment.

(*d*) The bolting of the cylinder unit on the end of the press frame and the removal of the existing screws and ratchet assemblies and the pressure-retaining weight from the other end. A short press is made by adding a loose plate which can be pinned or bolted to any existing holes in the cheese press frames.

The hydraulic cylinders attached to the presses (Plate 135) each measure 42 inches in length and 8 inches in diameter and are coupled in pairs with ¾-inch hose piping. The 6-inch diameter ramrod piston drives a 15-inch diameter head and with a 2 ft. 6 in. drive exerts a constant pressure of 8 to 10 tons, which is almost double the pressure exerted by the 160 lb. ball and lever of the ordinary cheese press.

The telescopic type of drive is usually in three sections and gives a longer drive up to 3 ft. 5 in., thereby allowing two extra export cheeses to be added after the preliminary pressing, whereas the 2 ft. 6 in. drive only accommodates one extra export size cheese. Present fittings are only for a 2 ft. 6 in. drive, but this will be increased on later models.

The cost of the hydraulic cheese press units is dependent on the number of cheese presses to be accommodated. The pump unit, which costs from £400 to £500, operates a number of cylinder units fitted to each press. These cylinder units cost approximately £250. Thus it would cost approximately £1,000 to set up two presses, £1,500 for four presses and £2,000 for six presses. The cost may seem heavy, but as

hydraulic cheese pressing is much quicker and is operated by a finger-controlled lever, as compared with the heavy work required to raise the ball and lever, the less arduous labour and saving of overtime rates are strong factors in its favour. Moreover, it represents a capital asset. Seven large Victorian factories are now completely fitted with hydraulic presses.

Other Equipment.

The projected development of regional electricity supplies in Queensland may open up the possibilities of the use of other labour and time-saving equipment in the near future in Queensland cheese factories. In this regard interesting items of equipment seen in Victorian cheese factories were as follows:—

1. *Metal jacketed vats,* holding water which is steam heated, provide better control over temperatures of milk and the curd in the vat, particularly in winter. However, because of the high environmental temperatures in Queensland, tests would be required to determine the advantages or otherwise of water-heated vats in this State. It was also noticed that screw jacks are fitted to tip the metal jacketed vats in Victoria for running off the whey; this eases the work with large vats, and reduces the strain on the vats themselves. It is doubtful if they are any quicker acting than the levers or legs used on Queensland vats.

2. *A centrifugal pump* coupled to a 6-inch piping, or an open guttering, has been used successfully for "wheying off" a vat quickly. A sanitary foot valve is inserted into the vat and the pump and valve need priming. The open guttering or pipe takes the whey to a whey separator situated outside the cheese room. Some pumps are directly coupled and gravity fed at the end of the chute.

3. *A stainless steel sieve,* 6 inches high, 2 feet long and 15 inches wide, placed inside the vat near the tap, is used to replace the piece of cheese cloth so often attached to the tap and which drops on the floor. To provide a large area for free drainage of whey and to fit comfortably against the vat when lowered into it, the sieve is shaped at right angles at the bottom and slopes back.

4. *An electric curd milling machine* with an oil immersion worm cuts the curd more evenly and is smoother running than a belt-driven curd mill. It can be driven by a 1 h.p. electric motor on the curd mill frame and as there is no need to clamp it on to the vat damage to the edges of the vat is avoided.

5. *A curd fork* is used in some factories which have not installed the combined travelling agitator and curd stirrer. The fork, which measures about 12 inches in width, has 10 curved prongs, each being 18 inches long. It forks the curd after milling and salting, thus dispensing with hand stirring.

6. *A curd filler* like a shell of a milk strainer sits on top of the hoop and facilitates hooping the curd.

7. *A mobile electric loader,* driven by a 3 h.p. motor and costing about £200, is an asset in a large factory. Six export cheeses can be placed comfortably on the platform or tray which is 2 ft. 6 in. square, and it is common to see nine export cheeses being wheeled to the

curing room. It is capable of being raised to the higher shelves, thus facilitating the placing of the cheeses on the shelves in the holding room. A rubber tyred unit is advantageous.

8. *Cooling of cheese holding rooms.* Unsuitable temperatures cause much cheese to deteriorate in quality in cheese holding rooms. Air conditioning is the ideal, as it enables the control of both temperatures and humidity. Refrigeration itself permits control of temperature but not humidity and so suffers the disadvantage that moisture from dripping coils favours the growth of cheese mites and moulds. To give better control by a less expensive method than air conditioning, a fan blowing against a brine cooler is being used in some Victorian factories. A fan blows direct on to an area of coils about the size of a truck radiator, which is also a little larger in area than the fan itself. At least two fans are needed on opposite sides of the room, but they must not be placed directly facing each other, otherwise the circulation of air is not efficient. The cost of each fan is about £80 to £90.

Suitable insulation of the walls and ceiling of the cheese-holding room is essential. Several thicknesses of fibre board treated against rodents is suitable; insul wool and solomit have also been used with some success. That portion of the refrigerated coils in the cheese room which is not immediately in front of the fans needs to be insulated to prevent condensation of moisture.

9. *Roller conveyors* are used on cheese factory platforms to facilitate the handling of milk on receival.

10. *Starter can trolleys* are used for easier handling of heavy starter cans.

11. *Can washers* (both rotary and straight through types) which save time and labour were observed to be used extensively in Victoria. They are an aid to quality improvement by ensuring the return to the farmer of properly washed cans.

Conclusion.

It will be appreciated from the foregoing observations that in Victoria the use of modern equipment has made it possible to reduce the cheesemaking process from 6½ to 5 hours without detriment to the quality of the cheese. The main factors which have enabled this are:—

(*a*) 2 to 2½ hours are still allowed for the curd to remain in the whey.

(*b*) Time is saved by wheying off quickly.

(*c*) Salt is added immediately after milling but the salted curd is allowed to mellow before hooping.

(*d*) The curd is handled throughout the process with less manual effort.

(*e*) Hydraulic pressing enables a quicker finish to the day's manufacture and reduces the pressing time for large cheeses.

(*f*) The shorter time of manufacture permits more attention to be given to cleaning of factory equipment and factory maintenance, all within the normal working day of 6 hours 40 minutes.

Appreciation is expressed to Mr. W. J. Park, Cheese Expert of the Department of Agriculture, Victoria, manufacturers of dairy equipment, and factory managers for assistance given to the author during his visit to Victoria.

Wool and its Uses.

G. R. MOULE, Director of Sheep Husbandry.

WOOL is one of the most useful fibres in the world. Others are important in providing clothes and meeting industrial requirements, but few have its versatility.

The fibres in most common use may be classified as natural fibres and artificial fibres. The natural fibres can be divided into those of animal origin, those of vegetable origin and those derived from minerals. The fibres of animal origin include wool, silk and hair. Amongst those of vegetable origin are cotton, flax and hemp; while asbestos is the outstanding example of the mineral fibres.

The artificial fibres can be classified on their origin as those coming from cellulose, from protein, from resins and plastics, and from other sources. The fibres madé from cellulose include rayon, with which most people are familiar, and algenata, which is made from seaweed. The sources of protein most commonly used for the manufacture of fibres are casein, soy bean and fish albumen. Nylon is the best known fibre in the group made from resins and plastics. Included in the miscellaneous class originating from other sources is fibre glass.

Woollen Articles.

Articles made from wool may be divided into five main groups:—

(i.) Woollens, which include blankets and flannels.
(ii.) Worsteds, which include closely woven suitings.
(iii.) Knitted garments, which range from jerseys to stockings.
(iv.) Felt, which may be fine and soft in hats or thick and coarse in Numnah pads under saddles.
(v.) Carpets.

Different types of manufacturing processes produce various finished woollen articles. The differences commence in the shearing sheds, where the wool is classed into lines uniform in such physical characters as staple length, tensile strength, character and colour. Before manufacture, the wool is blended, and variations in the amount of twist applied to the yarn during spinning carry this differentiation still further.

Wool is suitable for apparel manufacture because of its physical properties. These permit the making of woollen fabrics, which are warm, soft, durable and of satisfying appearance. Approximately four-fifths of the wool produced in the world each year is used for the

manufacture of wearing apparel. The remainder is used for carpet making. It is well known that woollen clothes are thermostatic—that is, they help the body maintain an even temperature. This is because wool itself is a bad conductor of heat and woollen fabrics entrap large amounts of air between their component fibres. This means that the body is surrounded by a layer of air at uniform temperature, which also acts as an insulating medium. It has been demonstrated that the warmth of rough fabrics, such as "Donegal" tweed and blankets, depends on their fluffy finish, as the comparatively loosely twisted yarn and the "nap" hold a large volume of insulating air. Woollen fabrics are twice as warm as rayon fabrics of the same dimensions, but rayon and silk are warmer than fabrics of the same density (that is, fabrics of the same weight per unit area). Woollen clothes have a remarkable capacity for absorbing sweat. The clothes worn by the average man weigh about 8 lb. and during usual spring weather in Brisbane would contain about one pound of moisture. During extremely dry weather this would decrease to about ½ lb. and in wet weather may increase to 1½ lb. This immediately raises questions as to where so much water can be secreted.

It has been found that the water forms a thin film around each fibre and it is interesting to know that the fibres in 1 lb. of 60's quality Merino wool present a total surface area of 800 square feet. The 3 lb. of wool in a suit of clothes would have a total area of 2,400 square feet, which accounts for the tremendous capacity of woollen garments to absorb moisture. This absorptive capacity makes an important contribution to the thermostatic properties of woollen garments. The rapid absorption of sweat decreases the rate of its evaporation and modifies its sudden cooling effects.

Wool is elastic and resilient, strong and durable, and these are important qualities in any fibres used for the manufacture of wearing apparel. Wool fibres are as strong as bronze and steel "fibres" of identical dimensions and they are from 2 to 4 times as strong as comparable 'fibres" of wood. However, dry silk is 2½-3 times as strong as wool and nylon is even stronger. Dry cotton is about twice as strong as wool, but these fibres are comparably weaker when wet. In addition they become quite "tender" when they are constantly wet with sweat. The ease with which the backs of cotton shirts and singlets tear after being worn for a full summer is evidence of this.

The durability of wool is apparent from the following table which compares the number of bends, each of 180 degrees, required to fracture single filaments.

Fibre.	Fibre Diameter in Microns.*	Number of Bends each of 180°.
Wool	24	20,000†
Nylon	14	20,000†
Cotton	17	3,200
Silk	15	1,800
Soy Bean	21	150
Cellulose (acetate) (Synthetic)	19	100

* 1 Micron = $\frac{1}{25400}$ inch.

† Some still unbroken.

All of these factors influence the uses to which wool might be put. Many producers refer to the "ideal" wool, apparently believing that there is one particular line of wool especially sought by the trade.

It is true that some lines of wool may command greater competition at auction than others, but it should be remembered that the wool trade is highly specialised and well organised. There is very little waste wool and uses can be found for most types. An appreciation of the uses to which various types of wools are put forms a useful background for any one interested in classing, and the following table presents this information in summarised form.

Wool.	Worsted.		Woollen.
	Woven.	Hosiery.	
Merino ..	Woven suits and dresses	Hosiery; good underwear	Woollen luxury blankets; rugs, coats and dresses; billiard cloths
Fine crossbred	Cheap suits and dresses	Average knit wear; beach wear	Better blankets; tweeds; coats; rugs
Medium to strong crossbred	Bunting; filler cloths; uniforms	Cheap knit wear ..	Blankets; tweeds; low grade coats

Diseases of Ducks.

Prepared by Officers of the Animal Health Station, Yeerongpilly, and the Poultry Branch.

THE number of ducks raised in Queensland has increased greatly in the last few years. The weight of dressed ducks exported increased from 134,473 lb. in the year 1947-48 to 389,760 lb. (valued at £46,284) in 1948-49. This rapid expansion of the industry has brought about an increased demand for information on the prevention and treatment of diseases of ducks. It has resulted also in many farmers commencing duck raising when they lacked the experience and the accommodation and equipment necessary to handle large flocks.

Owing to the peculiar feeding and watering habits of ducks, serious outbreaks of infectious diseases such as salmonellosis and cholera often develop among them once infection is introduced into a flock.

When sickness occurs, correct diagnosis of the cause of the trouble is necessary so that effective methods of controlling the outbreak may be commenced quickly. Owners of flocks suffering from disease may consult their local veterinarian or officer of the Department of Agriculture and Stock or they may send affected birds by rail direct to the Animal Health Station at either Yeerongpilly or Oonoonba. Live sick birds are preferred, but in some diseases death occurs suddenly and in such cases recently dead birds may be sent provided they will reach the laboratory within 24 hours. Dead specimens must be wrapped in cloth, then packed in a sound tin or wooden box. As laboratory examinations may take several days to complete, birds should be submitted as soon as possible after signs of ill health appear in a flock.

Full particulars of the management and feeding of the flock, the number and age of the birds affected and the nature of the complaint should accompany all specimens sent to the laboratory.

Cholera.

This is one of the most important diseases of ducks. It is caused by a bacterium (*Pasteurella aviseptica*), which also infects fowls and turkeys.

Ducks of all ages are susceptible. The death rate varies, but it may be high. In a recent outbreak near Brisbane 60 out of a pen of 70 ducks almost ready for market died in five days. Affected birds

become weak, fevered and unable to stand and diarrhoea may be present. Death usually occurs after 24 to 48 hours' sickness, but birds may die before symptoms are noticed.

On post-mortem examination, haemorrhages are found in various parts of the body, particularly in the heart, liver and spleen. The pericardium (heart sac) may be filled with fluid. There is usually excessive fluid or a thick yellow exudate in the abdominal cavity. The intestines are often inflamed and haemorrhagic. The liver is enlarged and is frequently dotted with pale areas of dead tissue. Laboratory bacteriological tests are necessary for the exact diagnosis of this disease.

Spread of cholera is favoured by insanitary and wet conditions, so ducks must be kept in clean, well-drained yards large enough to prevent overcrowding.

When cases of cholera occur, the whole of the affected group should be treated at once by giving either sodium sulphamezathine or sodium sulphamerazine at the rate of 0·2 per cent. in the drinking water. Both these drugs are available from poultry supply houses as a 16 per cent. solution. Two ounces of this solution is added to each gallon of drinking water on the first day and 1 oz. per gallon on subsequent days to give concentrations of 0·2 per cent. and 0·1 per cent. respectively. No other water should be available to the birds. Treatment is continued for 4 or 5 days.

As some of the birds in a flock in which an outbreak has occurred continue to harbour cholera bacteria for many months, the whole of the affected group should be held in isolation and sold for slaughter as soon as possible.

Salmonellosis.

This is an infectious disease caused by bacteria of the Salmonella group. It has also been called paratyphoid, infectious enteritis and "keel disease" of ducks. Many cases of salmonellosis in ducks have been diagnosed in Queensland during the last few years. Salmonella bacteria also infect man and domestic animals and birds.

Ducks of all ages are affected but ducklings in the first few weeks of life are most susceptible. Birds contract salmonellosis by ingesting contaminated feed or water. The usual source of infectious material is the excreta from either sick ducks or carriers (that is, ducks which appear healthy but harbour Salmonella bacteria in their intestines or ovaries). Some of the eggs laid by carrier ducks are infected and the ducklings hatched from them may therefore be affected. Other sources of infection are the excreta from either sick individuals or carriers among other animals (pigs, calves, chickens, rats, mice) or human beings.

Outbreaks of salmonellosis occur more frequently and more severely in flocks kept under insanitary conditions but occasionally outbreaks occur in well managed flocks.

Affected birds appear listless, refuse food and may die within 48 hours. Fever and diarrhoea may also occur. In ducklings there is often an ocular discharge which wets the down around the eyelids.

Upon post-mortem examination the intestines may be inflamed, and the spleen and the liver may be swollen and spotted. For correct diagnosis it is essential that Salmonella bacteria be identified in the internal organs by laboratory tests.

When salmonellosis occurs, seriously affected birds should be destroyed, and treatment with sulphamerazine or sulphamezathine similar to that recommended for cholera should be given to the affected groups. Ducks surviving an outbreak of salmonellosis should be isolated and marketed as soon as possible, because they may be carriers of the Salmonella bacteria.

The pens or yards in which cases have occurred should be thoroughly cleaned and then either disinfected or exposed to sunlight for several weeks before being used again.

Botulism.

This is caused by eating food, usually decomposed vegetable or animal material, in which the growth of a particular germ (*Clostridium botulinum*) has resulted in the production of a remarkably potent poison.

When ducks or fowls eat such contaminated food, paralysis of the neck, wings and legs occurs. The bird is unable to lift the head and the feathers pull out very easily. Affected birds eventually become very sleepy and appear almost dead.

Botulism is prevented by feeding only food which has not been allowed to decompose. When this disease occurs, an immediate search should be made for decaying meat, carcases or bones, rotting vegetables, or waterholes contaminated by such materials.

Spirochaetosis (Tick Fever).

This disease is caused by a micro-organism, *Borrelia anserina* (also called *Treponema* and *Spirochaeta anserinum*), which is spread usually by the fowl tick. Occasionally it is spread among fowls by the red mite and perhaps mosquitoes.

The disease occurs in fowls as well as ducks. The affected birds are fevered, have diarrhoea and are listless. Death may occur in a few days, but some birds recover. The death loss from spirochaetosis is sometimes heavy.

There is no effective treatment for spirochaetosis. It is prevented by eradication of ticks and red mites.

Enteritis.

Enteritis (inflammation of the bowel) may be caused by faulty feeding or feeding on decomposed food or garbage. It may be present also in the specific infectious diseases, salmonellosis, described above.

Coccidiosis.

Coccidiosis occurs occasionally amongst young ducks. It is similar to coccidiosis of chickens, except that blood is rarely seen in the droppings. It is prevented by keeping young stock in clean sanitary yards. Treatment with either sodium sulphamezathine or sodium sulphamerazine in the drinking water, as used for coccidiosis in chickens, appears to be effective.

The coccidia that infect ducks do not infect chickens, and vice versa.

Sinusitis.

This disease affects adult and growing ducks. It is an infectious disease which causes inflammation of the nasal cavities and sinuses. Sometimes the lungs and abdominal air sacs are also involved.

Affected birds lose weight, are lethargic and have a discharge from the nostrils. Later there is swelling of the face due to accumulation of cheesy material in the sinuses. The breathing becomes difficult and the birds gasp for breath. Death occurs after days or weeks of sickness.

To minimise the effects of sinusitis ducks should be given plenty of fresh green feed, to provide vitamin A, and provided with deep water vessels so that they may clean the bill and nostrils.

Treatment recommended is to withdraw the pus from the swollen sinuses with a hypodermic syringe fitted with a short stout needle and then inject 2 c.c. of a 4 per cent. solution of silver nitrate. The solution must be freshly prepared in distilled water.

Any batch of ducks in which sinusitis has occurred should be isolated from the remainder of the flock and then sold for slaughter as soon as it is marketable.

Staggers.

Vitamin A deficiency, cholera, spirochaetosis and salmonellosis can cause ducks to stagger, but in addition ducklings fed without the provision of water or suffering excessive heat without ample shade may also show this symptom. If ducks, particularly young stock, are deprived of water for even a few hours and then allowed to drink excessively they are also likely to stagger and die rather quickly. Care should be taken, therefore, to provide large water vessels so that the birds have water before them at all times. This point is sometimes overlooked when ducklings are growing rapidly and their water requirements are increasing from week to week.

"White Eye."

This is one of the common diseases of ducklings. The cause is unknown. Some authorities suggest that it is an infectious disease caused by a micro-organism, probably a virus. Locally the disease has occurred very frequently in ducklings deficient in vitamin A. Ducklings hatched from breeders fed on a ration deficient in vitamin A are apt to show symptoms during the first week of life, while ducklings reared on a deficient diet are apt to suffer during the second or third week. Wet, cold or dirty conditions predispose birds to this disease.

Ducklings are susceptible to the disease from a few days up to eight weeks of age. Outbreaks seldom occur in birds older than this.

Affected birds may die within a few hours, or they may linger for days. The eyes discharge tears and later the eye is covered with a whitish film so that the cornea becomes opaque. The nasal cavity and the sinuses may be filled with mucus. The ducklings become weak, roll on their backs and struggle until death. Diarrhoea is often present, so the down around the vent may be soiled.

Post-mortem examination reveals inflammation of the mucous membrane of the nasal cavity, but usually no abnormalities in other organs.

This is often a difficult disease to control. The affected birds or the affected batch of ducklings should be isolated from all others in the flock and kept in clean dry quarters. Additional vitamin A should be fed by adding cod liver oil or a vitamin A emulsion to the mash. Additional leafy green feed should also be given.

The water vessels should be deep enough to allow the ducklings to immerse their heads completely. The water should be changed frequently to keep it clean.

Vitamin A Deficiency.

Deficiency of vitamin A produces a variety of symptoms in ducks. In most cases there is a mucoid discharge from the eye and nose which usually becomes thick. On post-mortem examination the lining of the gullet may be studded with pustules, and the bursa (a small pouch connecting with the upper aspect of the vent) is filled with cheesy material. Occasionally the birds stagger and become paralysed before these symptoms are apparent.

Vitamin A is especially important for breeding ducks. Deficiency results in reduced egg production and later hatchability is greatly reduced. Furthermore, ducklings hatched from breeders fed a ration deficient in vitamin A may be weak, show symptoms of "white eye" and suffer high mortality in the first week or so of life.

This disease is prevented by providing ample fresh green feed (preferably good quality leafy lucerne) at all times or alternatively by the addition of vitaminised oil to the mash.

Rickets.

This is a disease of young ducks in which there is a lack of phosphate of lime in the bones, so that the bones are soft. It causes "leg weakness" and the birds are unable to stand or walk properly. The beak is soft and the rib bones are bent and beaded.

Rickets is usually due to deficiency of vitamin D, but occasionally deficiency of calcium (lime) or phosphorous or an imbalance of these constituents in the ration may be responsible.

Exposure to sunlight or the addition to the mash of a fish oil containing vitamin D will meet the requirements for this vitamin.

Calcium and phosphorous requirements are met by feeding bone meal in the mash and by providing shell grit or limestone grit.

Breeds of Fowls.

P. RUMBALL, Officer in Charge, Poultry Branch.

(*Continued from page 184 of March issue.*)

WYANDOTTES (Plate 136).

General Characteristics.

THE COCK.

Head.—Skull short and broad. Beak stout and well curved. Eyes intelligent and prominent. Comb rose, firmly and evenly set, low, square-fronted, gradually tapering towards the back and terminating in a well-defined spike or leader, which should follow the curve of the neck without any upward tendency; the top of it oval and covered with small and rounded points, the side outline being convex to conform to the shape of the skull. Face smooth and fine. Ear-lobes oblong, well developed, and smooth. Wattles of medium length, fine, and well rounded.

Neck.—Of medium length, well covered with hackle.

Body.—Short and deep, with well-rounded sides; broad round breast with straight keel; short back with full and broad saddle rising with a concave sweep to the tail; wings of medium size, well folded; tail medium size, but full, spread at base, the main feathers carried rather upright, the sickles of medium length.

Legs.—Of medium length, Thighs well covered with soft and webless feathers, the fluff fairly close and silky. Shanks strong, fine, well rounded, and free of feather or fluff. Toes (four) straight and well spread.

Carriage.—Graceful and well balanced, alert and active, but docile.

Plumage.—Fairly close and silky, not too abundant or fluffy.

Weight.—8½ lb.; cockerel, 7 lb.

THE HEN.

The general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—7 lb.; pullet, 5½ lb.

Colour.

Beak bright yellow, except Columbian, yellow, or horn. Eyes bright bay. Comb, face, wattles, and ear-lobes bright red. Legs and feet bright yellow.

THE COLUMBIAN.

Plumage.—Pearl-white with black markings; primaries (wing), black or black edged with white; secondaries, black inner web and white outer; the cock's neck-hackle broadly striped with black down the centre of each feather, such stripe to be entirely surrounded by a clearly-defined white margin with a decided white point (free from black outer edging or black tips) and his tail glossy green-black, the coverts either laced or not with white; the hens hackle bright intense black, each feather entirely surrounded by a white margin, and tail feathers black, except the top pair, which may or may not be laced with white. Remainder (in both sexes), white, entirely free of ticking, with slate, blue-white, or white under-colour.

THE WHITE.

Plumage.—Pure white, free from yellow or straw tinge.

Scale of Points.

THE COLUMBIAN.

Colour and markings (body 15, hackle 10, tail 5, flights 5, legs 5)	40
Type	25
Head (comb 10, eyes 5)	15
Size 8, condition 7	15
Texture	5
	100

THE WHITE.

Type	25
Colour	25
Size	15
Head	15
Legs	10
Condition	10
	100

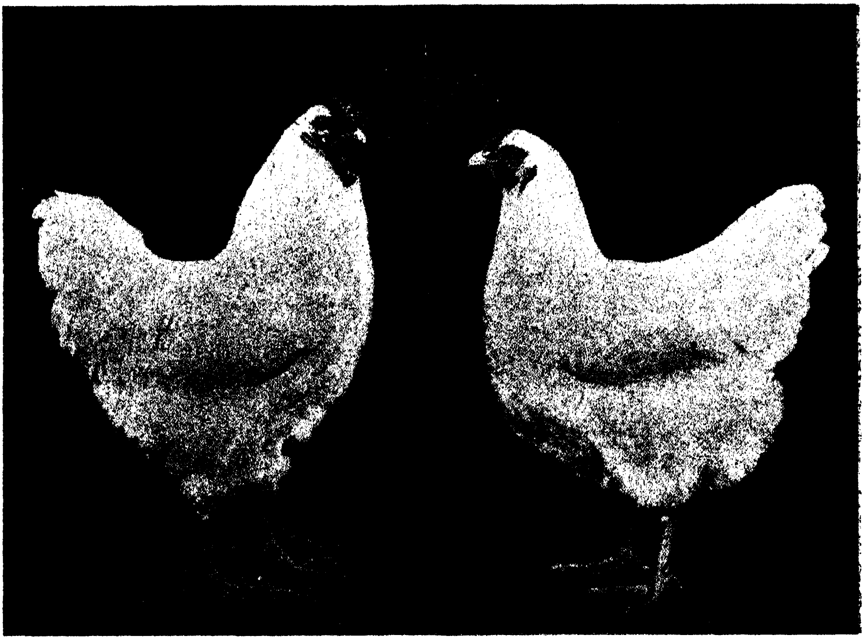


Plate 136.
White Wyandottes.

Serious Defects.—Any feathers on shanks or toes; permanent white or yellow in ear-lobe, covering more than one-third of its surface; comb other than rose, or falling over one side, or so large as to obstruct the sight; shanks other than yellow (except in adult cocks and hens, which may shade to light straw); any deformity. In Whites, other than white feathers; in Columbians, brown under-colour, green eyes, coarseness, inactivity, overhanging eyebrows.

The Wyandotte is an American breed, which is not bred extensively in this State. It is another breed made by a series of crosses. The first cross is believed to have been between the Sebright Bantam and Cochin Hen, and later Silver Spangled Hamburg, Buff Cochin, and Dark Brahma. The breed did not become popular commercially until the White was developed. This was a sport from the Silver breed.

The commercial possibilities of the breed were then visualised, as the birds were hardy, good foragers, and docile, and the chickens grew rapidly. The type of the Wyandotte ensures a carcase pleasing to the eye at any stage of development, and as its laying capacity was increased, it soon became popular; in fact, in Great Britain it is as popular as the White Leghorn.

This breed can be termed "the breed of curves." It is well-balanced, with legs set in the centre. From the top of its back to the bottom of its feet the distance should equal that from breast to end of tail. The body is carried horizontally, and depth of body is to be maintained. The maintenance of size is important, but coarseness has to be avoided. A good breadth of body and back is necessary to retain the meat-carrying characteristics of the carcase.

The principal eye defect is colour. Too many have light or almost green eyes. Age is responsible for some of this trouble, but greater selection for eye colour is desirable. Whiteness or paleness is the principal defect in the lobe.

The back has the appearance of being short, due to the curves and abundant hackle, saddle, and general set of the tail. The back shows a short space above the shoulders, which is level and then rises towards the tail, blending smoothly and evenly, making it difficult to see where the back terminates and the tail begins. This is what gives the Wyandotte its short appearance. The back should be broad with well-furnished saddle in the male, and a slight cushion or fullness of back held well up by a well-spread tail in the female. This gives the back line of the female from back to the end of the tail a slightly convex outline without the appearance of a Cochiny cushion. Breadth of back carried out in breadth of body, so that the side line of the fowl viewed from above shows smooth and even without hollow indentations, is to be aimed at. The breast must be full and prominent, not low enough to cover the hock line. The tendency to concave breasts, especially on side, and prominent gullet, is to be avoided.

The wings should not be too long; they should be folded snugly and carried level. Low-carried and slanting wings are more common in males than females. The top of the tail should be about level with the junction of the head and neck. Fairly full fluff is desired, but not so full as to hide the thighs. Do not go to the extreme and make the birds too fluffy.

The black of the Columbian is often inclined to be faded and not intense, and the strong contrast with the white is lost. This is offset by using breeding birds with dark slate under-colour. Select breeders with a clear white surface, with ½-inch to 1½-inch dark slate under-colour running to white next to the body. To attain the greatest success, keep away from breeders with pure white under-colour and save as breeders those showing no black on surface or white sections. It is also necessary to guard against brassiness, as this is a serious defect. It is more apparent in males and may appear on hackle, wing-bow, back, and saddle. In females it is more apparent in the white lacing of the hackle.

PLYMOUTH ROCK (Plate 137).

General Characteristics.

THE COCK.

Head.—Skull strong, but not thick. Beak short and stout. Eyes large and bright. Comb single, medium size, straight, and erect, with well-defined serrations, free from side sprigs. Face smooth. Ear-lobes fine texture, well-developed, and pendant. Wattles to correspond with size of comb, and moderately rounded.

Neck.—Of medium length and profusely covered with feathers flowing over the shoulders.

Body.—Large, deep, and compact; broad and well-rounded breast; broad back, of medium length, with saddle feathers of medium length and abundant; medium-sized wings carried well up, the bows and tips covered by the breast feathers and saddle-hackles.

Tail.—Rather small, rising slightly from the saddle, the sickles of medium length and nicely curved, the coverts being sufficiently abundant to cover the stiff feathers.

Legs.—Wide apart, stout, and strong, thighs 2 to 3 inches long (from hock to body), with shanks of medium length and free of feathers. Toes (four) strong, straight, and well spread.

Carriage.—Upright and smart.

Weight.—10 lb. to 12 lb.; cockerel, 8 lb. to 10 lb.

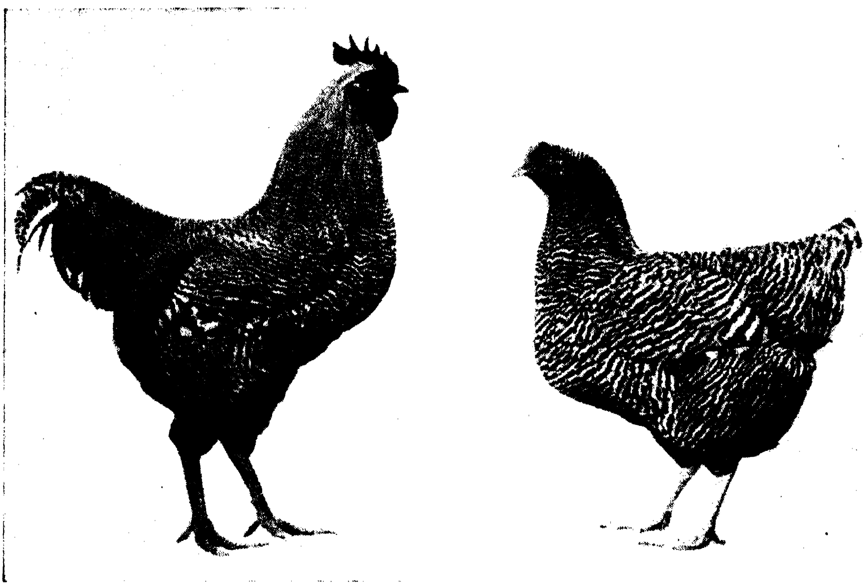


Plate 137.

Barred Plymouth Rock.—Pullet Line.

THE HEN.

The general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—7 lb. to 8 lb.

Colour.

Beak bright yellow. Eyes clear, rich bay. Comb, face, ear-lobes, and wattles bright red. Legs and feet bright yellow.

THE BARRED.

Plumage.—White, of blue tinge, each feather barred across with black of a beetle-green sheen, the bands moderately narrow and of equal breadth, and the colours sharply defined and not shading into each other. The barring should continue through the shaft of the feather and into the fluff and under-colour, and each feather finish with a black tip. The plumage as a whole should present a blue appearance and be uniform—that is, the hackles, wing-bows, and tail corresponding in colour with the other part of the body.

Scale of Points.

THE BARRED.

Type	20
Colour	20
Barring	20
Legs and feet	10
Condition	10
Size	10
Head	5
Tail	5
	100

Serious Defects.—**The slightest fluff or feather on the shanks or feet; shanks other than yellow; white ear-lobes; black, red, or white feathers in the Barred.**

The Plymouth Rock originated in America. Several lines of barred Plymouth Rocks were developed and united in 1878 to produce the modern breed. In its make-up American Dominque, Black Cochin, White Brahma, and Minorca appear to have been employed.

The barred Rock was a larger-framed bird and a fair producer, with the result that it became very extensively used for commercial purposes in America and Canada. In Queensland, although individual breeders have competed in egg-laying tests, the Rock has figured largely as a breed for the fancier and/or those engaged in the production of their own requirements of eggs and poultry meat.

There is a tendency in both sexes for size to deteriorate, and in breeding birds of standard weight or a trifle over should be selected. Extremes in size, however, should not be aimed for, as this will tend to depreciate the general utility characteristics of the breed. Light or greenish eyes should be avoided. White in lobe is a trouble with which breeders have to contend, although the whiteness which develops with age is not as serious as that in young stock. Split or slipped wings is a trouble fairly prevalent and to be selected against. Another wing trouble that must be avoided is twisted wing flights, which it is claimed suggest constitutional weakness.

Dark spots or green-shaded legs are frequently noted in females. This trouble is difficult to keep out, and constant attention is necessary. Dark shading will also be found in the beak of the female. It is not a serious defect—although yellow is preferable. Long shanks are associated with knock-knees and crooked toes. In addition to the defects already referred to, excessively slow-feathering birds should be avoided in breeding Rocks. These are more prevalent among males than female chickens.

Barred Rocks are bred exclusively by double mating, and cockerel-bred lines and pullet-bred lines are now definitely fixed. The crossing of cockerel and pullet lines would be disastrous from a standard point of view, and it is necessary, therefore, to carry on with the system.

It is as well to point out that black feathers appear among the plumage of the barred Rock. This does not indicate impurity of breed, nor are black feathers a serious defect unless numerous.

Cockerel Mating.—The male to be used should be standard. In colour the female needs to be clean black and white, with no sign of smut. The black bar should be two or three times as wide as the white. Surface colour even in all sections, with under-barring well defined. Some females will have black feathers and even some black wing flights. This denotes plenty of pigment and will assure strong barring in progeny. The colour of the legs and beak is usually darker than in exhibition females.

Pullet Mating.—With this mating, we look for the female progeny to have a barring of equal width, the black as black as possible without sheen and the white as white as possible. In this mating use males with white barring two to three times as wide as the black, and females of standard colour.

SUSSEX (Plate 138).

General Characteristics.

THE COCK.

Head.—Skull of medium size. Beak short, strong, and well curved. Eyes full and bright. Comb single, of medium size, upright, evenly serrated, and fitting closely. Face smooth. Ear lobes and wattles of medium size.

Neck.—Of medium length, with fairly full hackle.

Body.—Broad, deep, and long; square breast and carried well forward with long and deep breast-bone; wide shoulders; broad and flat back; wings carried closely; tail of moderate size, carried at an angle of 45 degrees.

Legs.—Short and rather wide apart, the thighs stout and the shanks strong and free from feathers. Toes (four) straight and well spread.

Carriage.—Graceful, showing length of back, vigorous and well balanced.

Plumage.—Close and free from any unnecessary fluff.

Weight.—9 lb.

THE HEN.

The general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—7 lb.

Colour.

Beak white or horn. Eyes, comb, face, wattles, and car-lobes red. Legs and feet white. Flesh and skin white.

THE LIGHT.

Plumage.—Pure white, with black-striped neck-hackle, black in flights, and black tail, the black centre of each feather of the neck-hackle to be entirely surrounded by a white margin.

Scale of Points.

Type	25
Size	20
Colour	20
Legs and feet	15
Head	10
Condition	10
	100

Serious Defects.—Rose comb; feather on shanks; other than four toes; any deformity.

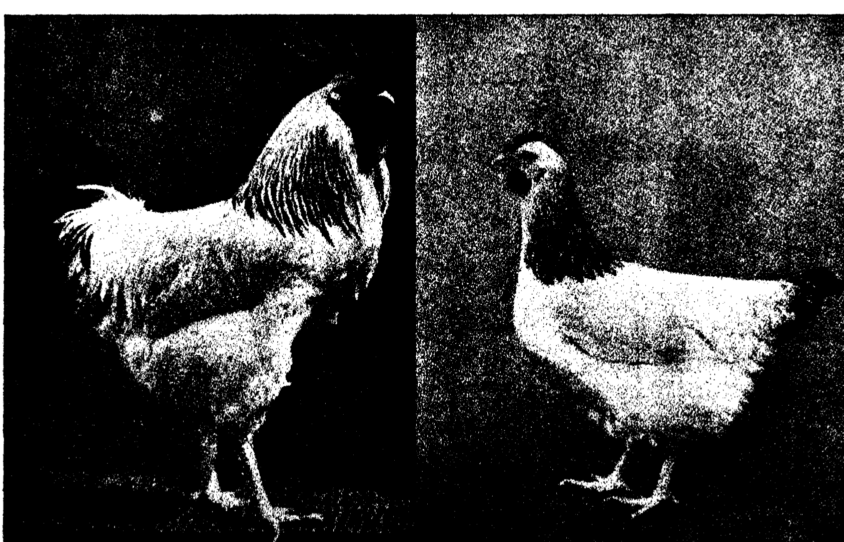


Plate 138.

Light Sussex.

The Sussex was developed in the south of England, but the breeds of fowls used are not definitely known, although it is generally believed that the Silver Grey Dorking entered extensively into its make-up.

The Sussex was developed primarily for its table qualities. Its white flesh, legs, and feet appeal to consumers. This fact, combined with the tenderness and juiciness of flesh and smallness of bone, enhances its table value. Although regarded as a table fowl, the Light Sussex is a fair layer, but the quality of flesh should not be sacrificed by efforts to increase the egg production.

A characteristic of the breed is that the rectangular body is reasonably long, deep, and wide. The breast-bone is reasonably long and well-fleshed. The head is somewhat coarse when compared with other utility breeds, but this can be overcome by selection.

The Light.—As indicated, the back is fairly long. This must not be overlooked, as there is a tendency for the back to be too short. Cut-away or flat breasts are very common, and this is a serious fault. Avoid any sloping or rounding of the back.

The Sussex, being descended from the Dorking, occasionally has five toes; this is definitely a disqualification on the show bench, and also as a breeder.

Plumage colour is clearly outlined in the standard. The principal faults are brassiness in males and dark or slaty under-colour. These are difficult to breed out.

JUNIOR FARMER CHAMPIONSHIP.

This year's State contest sponsored by the Australian Broadcasting Commission as a prelude to selecting the outstanding junior farmer in the Commonwealth was held in Brisbane during March and resulted in a win for Oliver Ulcoq, a prominent member of the Gayndah club, with Wilfred Day, of Tiaro, as runner-up.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 13th APRIL, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas.
Jersey	W. E. O. Meier, "Kingsford" Stud, Rosevale, via Rosewood.
A.I.S.	F. B. Sullivan, "Fermagh," Pittsworth.
Ayrshire ..	L. Holmes, "Benecccula," Yarranlea.
A.I.S.	D. Sullivan, Rossvale, via Pittsworth.
A.I.S.	W. Henschell, Yarranlea.
A.I.S.	Con O'Sullivan, "Navillus Stud," Greenmount.
Jersey	J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount.
Jersey	J. F. Lau, "Rosallen Jersey Stud," Goombungee.

Road Transporter Travel for Cattle.

Prepared in the Division of Animal Industry.

THE need for increased export of beef to the United Kingdom is well known and accepted. The beef producers of Queensland, individually and as a body, are anxious to increase production by any sound economic method and the United Kingdom people are certainly anxious to receive any additional supplies that may become available.

Whilst cattle killed in Queensland are produced in all parts of the State and the Northern Territory, the slaughter of cattle for export is confined to the seaboard. This necessitates very many cattle travelling hundreds of miles from the holdings to abattoirs.

Although wastage may not be great when cattle are transported by rail, it is very real when long journeys on the hoof have to be undertaken. This is, of course, accentuated when feed and water are not plentiful on stock routes, the more so if the "going" is rough and stony.

It is not uncommon for cattle to leave a property in prime condition and be only good stores by the time they arrive at their destination. The result of that is a very considerable loss of beef by reason of lowered dead weights, coupled with a decided reduction in the quality of the beef. The alternative is to hold the cattle on good pasture or crops for some weeks until they regain some or a l of their former condition. This can sometimes prove a very expensive course to pursue.

It has happened on occasions that, because of the closure of a stock route due to a long adverse season, fat cattle in some areas have not been able to "get out" except perhaps after a long and arduous diversion to avoid the drought stricken area.

The improvement of stock routes by providing better and more numerous watering facilities and, where necessary, their diversion through better country, will help, but such a course is not always practicable, and during exceptionally dry spells may not be of much assistance.

In the final analysis, some form of mechanical transport becomes necessary if wastage is to be prevented in circumstances which are unfavourable to the movement of cattle on the hoof. The construction

of railways is a slow and costly procedure and at present is out of the question owing to shortages of materials. The possibility of motor transport might at first be dismissed as fantastic, but nevertheless it has been proved practical in the Northern Territory and is fast being adopted in Queensland. It does seem, however, that at least where fat cattle are concerned it may well be essential that the roads which the motor transporters traverse be first class and preferably, except perhaps for short stretches, of bitumen construction.

Queensland Observations.

During a period of some eight months in 1949, observations were made on a series of movements of fat cattle by road train from the Northern Territory to a rail-head in Queensland and thence by rail to a city on the coast where the cattle were slaughtered by a butcher for the local trade.

The cattle travelled in batches of 60 (which was the capacity of the road train used), a distance of 198 miles by road and then 603 miles by rail. The journey by road transporter was made at night and the cattle then rested in railway trucking yards until the late afternoon. Most, but not all, of the consignments were again spelled in daylight en route to the coast, the rail journey taking 2 to 2½ days according to whether the cattle spelled or not.

During the period March to November, 45 consignments, comprising 2,700 head, were sent forward. As might well be expected, there was considerable variation in the way the various consignments dressed out when slaughtered on the coast. Most of the consignments were made up of cattle in good to prime condition, but there was an occasional consignment of cattle which were in only fair condition.

A close check was kept on the percentage of carcases which showed bruising. Excluding the first two consignments, in respect of which special factors operated, the best result obtained was 80 per cent. free from bruising, 10 per cent. showing slight bruising, and 10 per cent. showing extensive bruising; the worst result was 50 per cent. free, 25 per cent slight and 25 per cent. extensive, and the average result was 67 per cent. free, 18 per cent. slight and 15 per cent. extensive.

Bruising did not appear to be more noticeable in cattle travelling in the prime mover of the road train than in the trailer wagons. This was established by paint branding cattle in the prime mover prior to the commencement of the journey and checking on them at slaughter.

Bruising was more noticeable during the hotter months and it is thought that this may have been due to the cattle tiring more quickly. There was in fact good reason for concluding that tired cattle generally were distinctly more subject to bruising than rested cattle. It would seem highly desirable that cattle be well rested both before loading into the road transporters and again before loading into railway wagons.

Only one animal of the 2,700 head forwarded had to be totally condemned because of extensive bruising. There was one death in transit and one shortly after arrival at destination.

Cattle travelled long distances by rail immediately prior to slaughter and without any previous travel in road transporters are generally accepted as being subject to grading down, as the result of bruising, to the extent of about 20 per cent. of their numbers. This, of

course, does not allow of a direct comparison with what has been stated here in respect of cattle travelling first by road transport and then by rail, but there is the indication that the fact of the former does not markedly worsen the final result.

Cost of Transport.

The cost of moving cattle by road transporters is naturally a matter of very great interest. No figures are available for the movements under discussion in this article, but in connection with another series of movements which included travel both in Northern Territory and Queensland the cost has been given out (by the Australian Meat Board) as 1·9 pence per head per mile. This is considerably more than the cost of moving cattle either by rail or on the hoof, but nevertheless allows the method to be adopted as an alternative to driving cattle along stock routes which are lacking in feed and water.

Time alone will tell, but it does seem as though the road transporter is here to stay as a means of conveying cattle to market in the absence of railways.

Plate 139.

An Empty Road Transporter.

CHANGE OF ADDRESS.

Changes of address should be notified at least fourteen days before the date of issue with which the change is to take effect. The former address should be given as well as the full Christian names and surname of the subscriber.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

LIST OF PEST DESTROYERS REGISTERED IN QUEENSLAND UNDER "THE PEST DESTROYERS ACT OF 1939."

For the Period Commencing January, 1949, as at 2nd December, 1949. *(Continued from April issue.)*

Name of Pest Destroyer.	Per cent.	Active Constituents as Declared by Seller.	Queensland Wholesale Dealer.
		DDT PREPARATIONS—*continued.*	
MISCELLANEOUS—*continued.*			
Flytox DDT Insect Powder	3·0	para para dichlordiphenyltrichlorethane	R. A. Riddell, Rome street, Yeronga, Brisbane
	0·65	Total Pyrethrins	
Shell Aphis Spray	4·0	para para dichlordiphenyltrichlorethane	Shell Co. of Aust. Ltd., 301-7 Ann street, Brisbane
	78·0	Refined Mineral Oil	
Shell DDT Emulsion (25 per cent.)	25·0	para para dichlordiphenyltrichlorethane	Shell Co. of Aust. Ltd., 301-7 Ann street, Brisbane
Pestox No. 2 DDT Dust	2·0	para para dichlordiphenyltrichlorethane	L. L. Strange, Rep. Samuel Taylor Pty. Ltd., "Sunnyside," Miles street, Hawthorne, Brisbane
Rucide	50·0	para para dichlordiphenyltrichlorethane	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
Rudice DDT Dog Lotion	50·0	para para dichlordiphenyltrichlorethane	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
Rudust No. 4 General Agricultural Dust	2·0	para para dichlordiphenyltrichlorethane	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
Rudust No. 5 Field Crop Dust	5·0	para para dichlordiphenyltrichlorethane	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
Rulene DDT Field Crop Spray	25·0	para para dichlordiphenyltrichlorethane	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
Rulene DDT Garden and Orchard Spray	25·0	para para dichlordiphenyltrichlorethane	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
Runol DDT Emulsion Base	20·0	para para dichlordiphenyltrichlorethane	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
Bufidi	5·0	para para dichlordiphenyltrichlorethane	Tropical Dip & Chemical Co., Cambridge street, Rockhampton
Tropik DDT 2 per cent. Dust	2·0	para para dichlordiphenyltrichlorethane	Tropical Dip & Chemical Co., Cambridge street, Rockhampton
Tropik 15 per cent. DDT Dust	15·0	para para dichlordiphenyltrichlorethane	Tropical Dip & Chemical Co., Cambridge street, Rockhampton
Tropik DDT Emulsion	20·0	para para dichlordiphenyltrichlorethane	Tropical Dip & Chemical Co., Cambridge street, Rockhampton
Tropik 5 per cent. DDT Emulsion	5·0	para para dichlordiphenyltrichlorethane	Tropical Dip & Chemical Co., Cambridge street, Rockhampton
United 20 per cent. DDT Emulsion	20·0	para para dichlordiphenyltrichlorethane	United Chemicals Pty. Ltd., 91-7 Montague road, South Brisbane
Bovox Concentrated DDT Emulsion	8·4	para para dichlordiphenyltrichlorethane	Wilcox, Mofflin Ltd., Albert street, Brisbane
		FLUORINE INSECTICIDES.	
Lurotox	2·34	Sodium Silico Fluoride	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Chemist Roush Lice Powder for Poultry	10·0	Fluorine (F) as Sodium Fluoride	Morden Laboratories, 66 Charlotte street, Brisbane
Red Comb Dusting Powder	4·0	Fluorine (F) as Sodium Fluoride	Poultry Farmers Co-op. Soc. Ltd., Roma street, Brisbane
		FORMALIN.	
C.O.D. Formalin	40·0	Formaldehyde	Committee of Direction of Fruit Marketing, Turbot street, Brisbane
Red Comb Formalin	39·5	Formaldehyde (CH_2O)	Poultry Farmers Co-op. Soc. Ltd., Roma street, Brisbane
		FUNGICIDES (NOT SPECIFIED ELSEWHERE).	
Blue-Ammon Spray	4·5	Copper (Cu) as Cuprammonium Sulphate	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
	1·0	Ammonia	
Shirlan AG	25·0	Salicylanilide	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Shirlan WS	98·0	Sodium Salicylanilide	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
"Folisan"	20·0	Nitrobenzene Compound	R. A. Riddell, Rome street, Yeronga, Brisbane
Vallo Sali-cide Banana Dip	80·0	Sodium Salicylanilide	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
		HEXAETHYLTETRAPHOSPHATE.	
"Hexone"	100·0	Commercial Hexaethyltetraphosphate	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisban
"Vallo" H.E.T.P.	95·0	Hexaethyltetraphosphate	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
		IRON SULPHATE.	
A.C.F. Sulphate of Iron	19·7	Iron (Fe) as Iron Sulphate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane

		LIME SULPHUR.	
A.C.F. Lime Sulphur Solution	22·0	Sulphur (S) as Polysulphide Sulphur	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
F.D.L. Lime Sulphur Solution	20·0	Sulphur (S) as Polysulphide Sulphur	Fertiliser Distributers Pty. Ltd., Little Roma Street, Brisbane
Neptune Lime Sulphur Solution	20·0	Sulphur (S) as Polysulphide Sulphur	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
		MERCURY FUNGICIDES.	
Cerepest Cereal Fungus Deterrent	1·53	Mercury (Hg) as Benzyl Hydrag Acetate	Cerepest Laboratories, 200 Boundary street, Petrie Bight, Brisbane
Aretan	3·0	Organically Combined Mercury	R. A. Riddell, Rome street, Yeronga, Brisbane
Ceresan	1·5	Mercury (Hg) as Organic Mercury Compound	R. A. Riddell, Rome street, Yeronga, Brisbane
		METALDEHYDE PREPARATIONS.	
Lane's Killsem	1·25	Metaldehyde	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Lane's Snail–Slug	1·0	Metaldehyde	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Taylor's Metaldehyde No. 13 Snail and Slug Garden Pest Destroyer	1·4	Metaldehyde	F. C. Rowley, Rep. British Paints (Aust.) Pty. Ltd., 115 Queen street, Brisbane
		NICOTINE AND NICOTINE COMPOUNDS.	
A.C.F. Nico 3 Dust	3·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
Aeroflo Nico 3 Dust	3·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	Aeroflo Dusts & Sprays Pty., Redland Bay road, Redland Bay
Waratah Brand Nico Dust No. 3	3·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	Committee of Direction of Fruit Marketing, Turbot street, Brisbane
Waratah Brand Nico Dust No. 5	5·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	Committee of Direction of Fruit Marketing, Turbot street, Brisbane
Pestoxol Liquid Insecticide	3·7	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	Faulding F. H. & Co. Ltd., 200 Charlotte street, Brisbane
F.D.L. Tobacco Dust	0·5	Nicotine ($C_{10}H_{14}N_2$) as Tobacco Powder	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
		NICOTINE SULPHATE.	
A.C.F. Nicotine Sulphate	40·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
Lane's Nicotine Sulphate	40·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Waratah Nicotine Sulphate	40·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	Committee of Direction of Fruit Marketing, Turbot street, Brisbane
F.D.L. Nicotine Sulphate	40·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
"Vallo" Nicotine Sulphate	40·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
Hibiscus Nicotine Sulphate	40·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	Queensland Pastoral Supplies Pty. Ltd., 27 Bowen street, Brisbane
Felton Nicotine Sulphate	40·0	Nicotine ($C_{10}H_{14}N_2$) as Nicotine Sulphate	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
		PARADICHLOROBENZENE.	
A.C.F. Paradichlor	100·0	Commercial Paradichlorobenzene	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
		PARIS GREEN.	
A.C.F. Paris Green	55·0	Arsenic Trioxide (As_2O_3)	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
Paris Green	55·0	Arsenic Trioxide (As_2O_3)	A. M. Bickford & Sons Ltd., Tank street, Brisbane
Garden Brand Paris Green	55·0	Arsenic Trioxide (As_2O_3)	Cloudust Spray Manufacturers, Montague road, South Brisbane
Paris Green	55·0	Arsenic Trioxide (As_2O_3)	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
		PHENOLIC PREPARATIONS.	
Acco 15/20 Disinfectant	15·0	Tar Acids	Australian Chemical Co. Pty. Ltd., 305 Montague road, South Brisbane
Cobra Disinfectant	15·0	Phenols and Cresols	Goldsborough, Mort & Co. Ltd., 63 Eagle street, Brisbane
Morrison's Soluble Phenol	16·0	Phenols	A. H. Langdon & Co. Ltd., 303 Queen street, Brisbane
"Vallo" Ovicidal Wash	45·0 25·0 9·0	Tar Oil Mineral Oil Phenols	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
Mactaggart's Cattle Lice Exterminator	80·0	Tar Acids	Mactaggart's P.P. Co-op. Assn. Ltd., 70 Eagle street, Brisbane
Cooper's Milk Oil Fluid	18·0	Phenols and Cresols	New Zealand Loan & Mercantile Agency Co. Ltd., Eagle street, Brisbane
Cooper's Ovicide Tar Oil Winter Wash	48·0 10·0 20·0	Tar Oils Phenols Mineral Oils	Queensland Fruitgrowers Co-op. Soc. Ltd., Makerston street, Brisbane
Osmond's Dermos	2·75	Tar Acids	Osmond & Sons (Aust.) Pty. Ltd., 500 Stanley street, South Brisbane
Mericine Disinfectant	3·0	Tar Acids	N. S. Pixley, Eagle street, Brisbane
Octopus Phenyle	3·0	Tar Acids	N. S. Pixley, Eagle street, Brisbane
Taycol Disinfectant	15·0	Carbolic and Cresylic Acids	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane

LIST OF PEST DESTROYERS REGISTERED IN QUEENSLAND UNDER "THE PEST DESTROYERS ACT OF 1939."—*continued.*

For the Period Commencing January, 1949, as at 2nd December, 1949.

Name of Pest Destroyer.	Per cent.	Active Constituents as Declared by Seller.	Queensland Wholesale Dealer.
		PHOSPHORUS PASTES.	
Byrne's Electric Paste	0·6	Phosphorus (P)	Houghton & Byrne, Pty. Ltd., 161 Queen street, Brisbane
Chemist Roush Rat and Mice Paste	1·125	Phosphorus (P)	Morden Laboratories, 66 Charlotte street, Brisbane
S.A.P. Rabbit Poison	4·5	Phosphorus (P)	New Zealand Loan & Mercantile Agency Co. Ltd., Eagle street, Brisbane
Phosphorus Paste	1·3	Phosphorus (P)	Wm. Street & Son, 176 Ann street, Brisbane
Rat Death	1·9	Phosphorus (P)	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
Rat Doom	1·3	Phosphorus (P)	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
		PYRETHRUM POWDER (EXTRACT AND/OR PREPARATIONS).	
Osmond's "Di-Pest" Fly Spray	0·1	Total Pyrethrins	Osmond & Sons (Aust.) Pty. Ltd., 500 Stanley street, South Brisbane
Rawleigh's Pyrethro Fly Killer	0·13	Total Pyrethrins	Robinson & Bott Pty. Ltd., 459 Adelaide street, Brisbane
Mustdie Powder	0·61	Total Pyrethrins	Taylors Elliotts Pty. Ltd. 150 Charlotte street, Brisbane
		RAT BAITS OTHER THAN PHOSPHORUS.	
A.C.F. Zinc Phosphide Rat Baits	0·5	Commercial Zinc Phosphide	A. C. F. & Shirleys Fertilizers Ltd., Little Roma Street, Brisbane
Ra-Gas	32·0	Pot. Nitrate	Poultry Farmers Co-op. Soc. Ltd., Roma street, Brisbane
	32·0	Sulphur	
		SHEEP DIPS.	
ARSENICAL—LIQUID.			
Buzacott's Arsenical Liquid Dip	46·6	Arsenic Trioxide (As_2O_3)	Buzacotts (Qld.) Ltd., 443 Adelaide street, Brisbane
	15·0	Phenols and Cresols	
Harton Sheep Dip	64·0	Arsenic Trioxide (As_2O_3)	Goldsborough, Mort & Co. Ltd., Eagle street, Brisbane
	7·2	Cresols	
G.B.A. Sheep Dip	60·0	Arsenic Trioxide (As_2O_3)	Graziers' Benefit Assn. Pty. Ltd., 65 Montague road, South Brisbane
	3·5	Tar Acids	
Mactaggart's Arsenical Liquid Sheep Dip	30·0	Arsenic Trioxide (As_2O_3)	Mactaggarts P.P. Co-op. Assn. Ltd., 70 Eagle street, Brisbane
	16·0	Creslyic Acid	
Century Sheep Dip	35·0	Arsenic Trioxide (As_2O_3)	McGlew & Co., Ryan House, 239 Charlotte street, Brisbane
	3·5	Tar Acids	
Standard Sheep Dip Liquid Arsenical	30·0	Arsenic Trioxide (As_2O_3)	Qld. Chemical & Dist. Co., 107 Eagle street, Brisbane
Elliotts One Twenty-Eight Liquid Dip	64·0	Arsenic Trioxide (As_2O_3)	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
United Liquid Arsenical-Cresol Sheep Dip	30·0	Arsenic Trioxide (As_2O_3)	United Chemicals Pty. Ltd., 91-7 Montague road, South Brisbane
	16·0	Cresols	
Vacdip Q	15·0	Arsenic Trioxide (As_2O_3)	Vacuum Oil Co. Pty. Ltd., 99 Creek street, Brisbane
	5·5	Tar Acids	
ARSENICAL—PASTE.			
Campbell's "Policeman Fly" Sheep Spraying Soap	30·0	Arsenic Trioxide (As_2O_3)	Campbell Bros. Pty. Ltd., Campbell street, Bowen Hills, Brisbane
ARSENICAL—POWDER.			
Quibell's "Special" Powder Sheep Dip (Prompt Action)	21·6	Arsenic Trioxide (As_2O_3)	Dalgety & Co., Elizabeth street, Brisbane
	0·7	Rotenone and Allied Substances	
Quibell's Powder Sheep Dip (Standard)	22·25	Arsenic Trioxide (As_2O_3)	Dalgety & Co., Elizabeth street, Brisbane
Vallo Dual Purpose Powder Sheep Dip	21·0	Arsenic Trioxide (As_2O_3)	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
	0·7	Rotenone and Allied Substances	
Vallo Powder Sheep Dip	21·0	Arsenic Trioxide (As_2O_3)	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
Cooper's Sheep Dipping Powder	22·5	Arsenic Trioxide (As_2O_3)	New Zealand Loan & Mercantile Agency Co. Ltd., Eagle street, Brisbane
Cooper's Sheep Dipping Powder (Quick Acting)	22·0	Arsenic Trioxide (As_2O_3)	New Zealand Loan & Mercantile Agency Co. Ltd., Eagle street, Brisbane
	0·7	Rotenone and Allied Substances	

"Viper" Powder Dip	20·0	Arsenic Trioxide (As_2O_3)	Osmond & Sons (Aust.) Pty. Ltd., 500 Stanley street, South Brisbane
Sickle Brand Arsenical Powder Sheep Dip	21·0	Arsenic Trioxide (As_2O_3)	Qld. Primary Producers Co-op. Assn. Ltd., Creek street, Brisbane
Sickle Brand Double Action Powder Sheep Dip	21·0	Arsenic Trioxide (As_2O_3)	Qld. Primary Producers' Co-op. Assn. Ltd., Creek street, Brisbane
	0·7	Total Ether Extractives } from Derris	
	0·175	Rotenone } from Derris	
Elliott's Udip	23·0	Arsenic Trioxide (As_2O_3) as Arsenious Oxide	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
Elliott's Ninety-four Powder Dip	25·0	Arsenic Trioxide (As_2O_3)	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
	0·24	Rotenone	
Little's Supreme Powder Sheep Dip (Rapid Acting)	19·5	Arsenic Trioxide (As_2O_3)	Wilcox, Mofflin Ltd., Albert street, Brisbane
	0·7	Rotenone and Allied Substances	
Little's Powder Sheep Dip (Standard)	21·0	Arsenic Trioxide (As_2O_3)	Wilcox, Mofflin Ltd., Albert street, Brisbane

BENZENE HEXACHLORIDE.

Quibell's Gamma Sheep Dip	6·0	gamma isomer of Benzene Hexachloride	Dalgety & Co. Ltd., Elizabeth street, Brisbane
Cooper's Gamatox Sheep Dip	6·0	gamma isomer of Benzene Hexachloride	New Zealand Loan & Mercantile Agency Co. Ltd., Eagle street, Brisbane
Sickle Brand Gamalene Liquid Sheep Dip	3·5	gamma isomer of Benzene Hexachloride	Qld. Primary Producers Co-op. Assn. Ltd., Creek street, Brisbane
Little's Numex Sheep Dip	6·0	gamma isomer of Benzene Hexachloride	Wilcox, Mofflin Ltd., Albert street, Brisbane

PHENOLIC.

Kreola Sheep Dip	20·0	Tar Acids	Australian Chemical Co. Pty. Ltd., 305 Montague road, South Brisbane
Quibell's Liquid Sheep Dip and Cattle Wash	18·0	Tar Acids	Dalgety & Co. Ltd., Elizabeth street, Brisbane
Harton Lact-Oil Fluid	18·0	Phenols and Cresols	Goldsborough, Mort & Co. Ltd., Eagle street, Brisbane
Morrison's Phenolic Sheep Dip	16·0	Phenols	A. H. Langdon & Co. Ltd., 303 Queen street, Brisbane
Vallo Fluid Sheep Dip	18·0	Tar Acids	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
Mactaggart's Special Phenolic Sheep Dip	20·0	Tar Acids	Mactaggarts P.P. Co-op. Assn. Ltd., 70 Eagle street, Brisbane
Kymac Sheep Dip	57·0	Cresols	New Zealand Loan & Mercantile Agency Co. Ltd., Eagle street, Brisbane
	0·33	Rotenone and Allied Substances	
Osmond's "Ivory" Fluid Sheep Dip		18 to 20 Tar Acids	Osmond & Sons (Aust.) Pty. Ltd., 500 Stanley street, South Brisbane
"Standard" Sheep Dip	20·0	Tar Acids	Qld. Chemical & Dist. Co., 107 Eagle street, Brisbane
Two Twenty-One Liquid Dip	0·625	Rotenone } from Derris	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
	2·5	Total Ether Extractives } from Derris	
	35·0	Cresylic Acid	
United Sheep Dip No. 2 (Liquid Phenolic)	20·0	Tar Acids	United Chemicals Pty. Ltd., 91–7 Montague road, South Brisbane
Little's Improved Fluid Dip	19·0	Tar Acids	Wilcox, Mofflin Ltd., Albert street, Brisbane

MISCELLANEOUS.

Hart's Immunol New Super Sheep Dip	1·0	Oleo Resin Derris	Queensland Pastoral Supplies Ltd., 27 Bowen street, Brisbane
	29·8	Arsenic Trioxide (As_2O_3)	
	40·7	Cresol	
	0·1	gamma isomer of Benzene Hexachloride	
Elliott's Sixty-Seven Liquid Dip	20·0	Polysulphide Sulphur	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
Elliott's Thirty-Five Liquid Dip	25·0	Arsenic Trioxide (As_2O_3)	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
	0·25	Rotenone } from Derris	
	1·0	Total Ether Extractives } from Derris	
	67·0	Cresylic Acid	

JETTING FLUIDS (*See also* SHEEP DIPS ARSENICAL).

Acco-Jet	34·4	Arsenic Trioxide (As_2O_3)	Australian Chemical Co. Ltd., 305 Montague road, South Brisbane
	5·4	Cresylic Acid	
Buzacott's "Spretter" Fluid	46·6	Arsenic Trioxide (As_2O_3)	Buzacotts (Qld.) Ltd., 443 Adelaide street, Brisbane
	15·0	Phenols and Cresols	
Harton Jetting Fluid	70·0	Arsenic Trioxide (As_2O_3)	Goldsborough, Mort & Co. Ltd., Eagle street, Brisbane
"Max-Jet"	29·5	Arsenic Trioxide (As_2O_3)	Mactaggarts P.P. Co-op. Assn. Ltd., Eagle street, Brisbane
Jet-O-Leen	46·6	Arsenic Trioxide (As_2O_3)	Walter Reid & Co. Ltd., Charlotte street, Brisbane
Elliott's Calarsenite	43·0	Arsenious Oxide (As_2O_3) as Calc. Arsenite	Taylors Elliotts Pty. Ltd., 150 Charlotte street, Brisbane
United Improved Jetting	46·6	Arsenic Trioxide (As_2O_3)	United Chemicals Pty. Ltd., 91–7 Montague road, South Brisbane
	15·0	Phenols and Cresols	

LIST OF PEST DESTROYERS REGISTERED IN QUEENSLAND UNDER "THE PEST DESTROYERS ACT OF 1939."—*continued.*

For the Period Commencing January, 1949, as at 2nd December, 1949.

Name of Pest Destroyer.	Active Constituents as Declared by Seller.		Queensland Wholesale Dealer.
	SHEEP PREPARATIONS.		
	Per cent.		
Kreeola Fly-Blow Dressing	78·0	Tar Oils	Australian Chemical Co. Pty. Ltd., 305 Montague road, South Brisbane
Acco Fly-Blow Dressing	80·0	Tar Oils	Australian Chemical Co. Pty. Ltd., 305 Montague road, South Brisbane
B.T.B. 15 Fly-Blow Dressing Concentrate "A"	12·9	Boron (B) as Boric Acid	Campbell Bros. Pty. Ltd., Campbell street, Bowen Hills
B.T.B. 15 Fly-Blow Dressing Concentrate "B"	50·0	Tar Oil	Campbell Bros. Pty. Ltd., Campbell street, Bowen Hills
Flynox	6·5	Tar Acids	Dalgety & Co. Ltd., 291–301 Elizabeth street, Brisbane
B.H.P. Blow Fly Oil	10·0	Phenols and Homologues	Elder, Smith & Co. Ltd., 334–8 Queen street, Brisbane
Benex Blow-Fly Dressing	0·52	gamma isomer of Benzene Hexachloride	Goldsborough, Mort & Co. Ltd., Eagle street, Brisbane
	4·0	para para dichlordiphenyltrichlorethane	
	20·0	Orthodichlorbenzene	
	8·0	Tar Acids	
Grazcos B.K.B. Fly Dressing	2·5	Boron (B) as Boric Acid	Grazcos Co-op. Ltd., 356 Queen street, Brisbane
	3·1	Tar Acids	
	5·2	Orthodichlorbenzene	
Flyxane	3·5	gamma isomer of Benzene Hexachloride	Grazcos Co-op. Ltd., 356 Queen street, Brisbane
G.B.A. Fly Oil	4·0	Cresylic Acid	Graziers' Benefit Assn. Pty. Ltd., 65 Montague road, South Brisbane
	4·0	Eucalyptus	
Improved Graziers' Friend	11·1	Arsenic Trioxide (As_2O_3)	Graziers' Friend Manufacturing Co., 19 Elfin street, East Brisbane
	0·9	Tar Acids	
I.C.I. B.K.B. Blowfly Dressing	2·5	Boron (B) as Boric Acid	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
	3·1	Tar Acids	
	5·2	Orthodichlorbenzene	
Morrison's Fly Blown Sheep Oil	4·0	Tar Acid	A. H. Langdon & Co. Ltd., 303 Queen street, Brisbane
Mactaggart's Antiseptic Sheep Fly Oil	75·0	Tar Oils	Mactaggarts P.P. Co-op. Assn. Ltd., 70 Eagle street, Brisbane
Vetmac Fly Oil	8·0	Boracic Acid	A. H. McDonald & Co., 99–103 Mary street, Brisbane
	1·0	Zinc Sulphate	
	2·0	Phenols	
	0·6	para para dichlordiphenyltrichlorethane	
	1·0	Essential Oils	
Century Fly Oil	4·0	Cresylic Acid	McGlew & Co., 239 Charlotte street, Brisbane
	4·0	Eucalyptus	
Squatter Blowfly Oil	2·95	Cresylic Acid	Neptune Oil Co. Pty. Ltd., 301–7 Ann street, Brisbane
Blo-Fli-Di	7·5	Naphthalene	The Nightingale Supply Co. Ltd., 1078 Lower Ann street, Brisbane
	0·8	Sulphur	
	13·7	Benzol	
Osmond's "Osblo"	8·4	Tar Acids	Osmond & Sons (Aust.) Ltd., 500 Stanley street, South Brisbane
	2·5	Phenols	
	0·75	Eucalyptus	
Elephant Brand Jumbo Fly-Blow Dressing	15·0	Tar Acids	N. S. Pixley, Eagle street, Brisbane
"Fleeco"	75·0	Tar Oil	Qld. Chemical & Distributing Co., 107 Eagle street, Brisbane
	2·0	Cresols	
Blowfoil	2·0	Cresylic Acids	Qld. Pastoral Supplies Pty. Ltd., 27 Bowen street, Brisbane

Hart's Immunol B.K.B. Concentrated Blowfly Dressing	6·8	Boron (B) as Boracic Acid	Queensland Pastoral Supplies Pty. Ltd., 27 Bowen street, Brisbane
	6·7	Tar Acids	
	14·2	Orthodichlorbenzene	
Way Blo	33·33	Eucalyptus (Terpenes, Aldehydes, Ketones)	Qld. Pastoral Supples Pty. Ltd., 27 Bowen street, Brisbane
	5·55	Chlorinated Benzene	
	2·77	Phenol and Homologues	
Fly–O–Leen	4·0	para para dichlordiphenyltrichlorethane	Walter Reid & Co. Ltd., Charlotte street, Brisbane
	0·52	gamma isomer of Benzene Hexachloride	
	8·0	Tar Acids	
	20·0	Orthodichlor benzene	
Kleep Blowfly Dressing	15·0	para para dichlordiphenyltrichlorethane	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
	44·0	Monochlor Benzene	
	1·5	Synthetic Phenolic Bactericide	
	1·5	Sulphanilamide	
Kleenflox plus DDT	61·0	Mineral Oil	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
	8·0	Abietic Acid	
	4·0	Eucalpyti Oleum	
	3·0	Phenols	
	1·0	para para dichlordiphenyltrichlorethane	
Shell Defiance Blow-Fly Oil	2·95	Cresols	Shell Co. of Aust. Ltd., 301–7 Ann street, Brisbane
"Austral" Blow Fly Dressing Oil	2·5	Eucalyptus Oil	Taylors Elliotts Pty. Ltd., 150–160 Charlotte street, Brisbane
	2·5	Dichlorbenzene	
Elliott's B.K.B. Blowfly Dressing	2·5	Boron (B) as Boric Acid	Taylors Elliotts Pty. Ltd., 150–160 Charlotte street, Brisbane
	3·1	Tar Acids	
	5·2	Orthodichlorbenzene	
	8·6	Kerosene	
Woollo Fly Blow Oil and Lamb Marking Dressing	80·0	Tar Oils	United Chemicals Pty. Ltd., 91–7 Montague road, South Brisbane
Wilmoff B.K.B. Blowfly and Lamb Marking Dressing	2·5	Boron (B) as Boracic Acid	Wilcox, Mofflin Ltd., 68 Albert street, Brisbane
	9·3	Mineral Oil	
	5·4	Orthodichlorbenzene	
	5·3	Lysol	
Wilmo Sheep Blowfly Dressing	55·0	Tar Oils	Wilcox, Mofflin Ltd., 68 Albert street, Brisbane
	5·0	Tetrachlorethylene	
G.M.X.	0·72	gamma isomer of Benzene Hexachloride	Wilcox, Mofflin Ltd., 68 Albert street, Brisbane
	7·5	Tar Acids	
	7·5	Tetrachlorethylene	

SPRAYING OILS AND EMULSIONS.

Volck	80·0	Refined Petroleum Oils	A.C.F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
Albarol White Oil	80·0	Petroleum Oil	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Campbell's Citrus Orchard Spray	6·0	Fish Oils	Campbell Bros. Pty. Ltd., Campbell street, Bowen Hills, Brisbane
Campbell's Market Garden Spray	12·0	Fish Oils	Campbell Bros. Pty. Ltd., Campbell street, Bowen Hills, Brisbane
F.D.L. White Spraying Oil	82·0	Petroleum Oil (Heavy)	Fertiliser Distributers Pty. Ltd., Little Roma street, Brisbane
"Vallo" Red Spraying Oil	89·0	Red Mineral Oil	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
"Vallo" White Oil Emulsion	82·5	Mineral Oil	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
Neptune Clarifol Spraying Oil	85·0	Mineral Oil	Neptune Oil Co. Pty. Ltd., 301 Ann street, Brisbane
Neptune Palsol (Pale Spraying Oil)	82·0	Mineral Oil	Neptune Oil Co. Pty. Ltd., 301 Ann street, Brisbane
Neptune Prepared Red Spraying Oil C.	70·0	Mineral Oil	Neptune Oil Co. Pty. Ltd., 301 Ann street, Brisbane
Neptune Prepared White Spraying Oil	84·0	Refined Mineral Oil	Neptune Oil Co. Pty. Ltd., 301 Ann street, Brisbane
Neptune Red Spraying Oil A	85·0	Mineral Oil	Neptune Oil Co. Pty. Ltd., 301 Ann street, Brisbane
Cooper's Alboleum	80·0	Hydrocarbon Oil	Qld. Fruitgrowers Soc. Ltd., Makerston street, Brisbane
Shellicide D	77·0	Refined Mineral Oil	Shell Co. of Aust. Ltd., 301–7 Ann street, Brisbane
Shell Pale Spray	77·0	Refined Mineral Oil	Shell Co. of Aust. Ltd., 301–7 Ann street, Brisbane

LIST OF PEST DESTROYERS REGISTERED IN QUEENSLAND UNDER "THE PEST DESTROYERS ACT OF 1939."—*continued.*

For the Period Commencing January, 1949, as at 2nd December, 1949.

Name of Pest Destroyer.	Active Constituents as Declared by Seller.		Queensland Wholesale Dealer.
	Per cent.		
		SHEEP PREPARATIONS—*continued.*	
Shell Red Spray	76·0	Refined Mineral Oil	Shell Co. of Aust. Ltd., 301–7 Ann street, Brisbane
Shell Sprayol	76·0	Refined Mineral Oil	Shell Co. of Aust. Ltd., 301–7 Ann street, Brisbane
Shell Weevil Oil	85·0	Solution of Nitrated Phenols in Mineral Oil	Shell Co. of Aust. Ltd., 301–7 Ann street, Brisbane
Gargoyle Pale Spraying Oil	74·6	Petroleum Oil	Vacuum Oil Co. Pty. Ltd., 99 Creek street, Brisbane
Gargoyle Red Spraying Oil	78·2	Red Mineral Oil	Vacuum Oil Co. Pty. Ltd., 99 Creek street, Brisbane
Gargoyle White Spraying Oil	71·3	Petroleum Oil	Vacuum Oil Co. Pty. Ltd., 99 Creek street, Brisbane
		STERILISERS AND/OR CLEANSERS.	
Lavaloid	1·2	Phosphoric Acid (P_2O_5) as Trisodium Phosphate	Alfa-Laval Separator Co. (Q.) Pty. Ltd., 266 Roma street, Brisbane
	1·0	Silica (SiO_2) as Sodium Metasilicate	
Lakteel	47·0	Sodium Oxide (Na_2O) as Sodium Carbonate	H. Blaiklock & Co. Pty. Ltd., 150 Mary street, Brisbane
	5·5	Sodium Oxide (Na_2O) as Sodium Bicarbonate	
Ardesy	22·0	Soda (Na_2O) as Sodium Metasilicate	Campbell Bros. Pty. Ltd., Campbell street, Bowen Hills, Brisbane
Campbell's Liquid Dairy-Chlor	10·0	Available Chlorine	Campbell Bros. Pty. Ltd., Campbell street, Bowen Hills, Brisbane
C.B. Cleanser	50·0	Soda (Na_2O) as Sodium Carbonate	Campbell Bros. Pty. Ltd., Campbell street, Bowen Hills, Brisbane
	0·04	Silica (SiO_2) as Sodium Metasilicate	
"Snow Palm" Dairy Cleanser	42·0	Soda (Na_2O)	Campbell Bros. Pty. Ltd., Campbell street, Bowen Hills, Brisbane
Zanic Steriliser C	25·3	Available Chlorine	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
"Calhypo"	30·0	Available Chlorine	Milking Machine Supplies Pty. Ltd., 330–2 Adelaide street, Brisbane
Clorize	5·0	Available Chlorine	Nightingale Supply Co. Ltd., 107a Lower Ann street, Brisbane
Westolite	15·0	Phosphoric Acid (P_2O_5) as Trisodium Phosphate	Norris Agencies Pty. Ltd., 639 Ann street, Brisbane
Osmol Cleansing Powder	57·0	Soda (Na_2O) as Sodium Carbonate	Osmond & Sons (Aust.) Pty. Ltd., 500 Stanley street, South Brisbane
Chlorital	10·0	Available Chlorine	Qld. Chemical & Distributing Co., 107 Eagle street, Brisbane
Dairywhite No. 1	7·5	Phosphoric Acid (P_2O_5) as Trisodium Phosphate	Qld. Chemical & Distributing Co., 107 Eagle street, Brisbane
	18·5	Sodium Oxide (Na_2O) as Sodium Carbonate	
Rawleigh's Cleanser and Water Softener	18·0	Phosphoric Acid (P_2O_5) as Trisodium Phosphate	Robinson & Bott Pty. Ltd., 459 Adelaide street, Brisbane
Lamol AL Grade Detergent	27·5	Sodium Oxide (Na_2O) as Sodium Carbonate	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
	3·33	Sodium Oxide (Na_2O) as Sodium Silicate	
	0·36	Sodium Oxide (Na_2O) as Sodium Bicarbonate	
Lamol SF Grade Detergent	46·7	Sodium Oxide (Na_2O) as Sodium Carbonate	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
	6·2	Sodium Oxide (Na_2O) as Sodium Hydroxide	
	1·8	Phos. Pentoxide (P_2O_5) as Tri-Basic Phosphate	
	4·0	Silicate (SiO_2) as Sodium Metasilicate	
		STRYCHNINE.	
Alkaloid Strychnine	100·0	Strychnine Alkaloid ($C_{21}H_{22}O_2N_2$)	Qld. Pastoral Supplies Pty. Ltd., 27 Bowen street, Brisbane
Strychnine Brucine	43·0	Strychnine ($C_{21}H_{22}O_2N_2$)	Qld. Pastoral Supplies Pty. Ltd., 27 Bowen street, Brisbane
		SULPHUR.	
POWDERED.			
A.C.F Powdered Sulphur	99·0	Sulphur (S)	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
Powdered Sulphur	99·5	Sulphur (S)	G. Horsburgh & Co. Pty. Ltd., 320 Kent street, Maryborough
Vallo Powdered Sulphur	99·5	Sulphur (S)	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
Pereoder			
DISPERSIBLE.			
Wetomic Sulphur	97·0	Sulphur (S) as Elemental Sulphur	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Cooper's Special Dispersible Sulphur	73·0	Sulphur (S)	Queensland Fruitgrowers' Co-op. Soc. Ltd., Makerston street, Brisbane

" Wetsul " Wettable Sulphur	97·0	Sulphur (S) as Elemental Sulphur	Queensland Fruitgrowers Soc. Ltd., Makerston street, Brisbane
Sulfaloid Dispersible Sulphur	75·0	Sulphur (S)	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
DUSTING.			
A.C.F. Sulphur Dust	90·0	Sulphur (S) as Powdered Sulphur	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
Vallo Dusting Sulphur	90·0	Sulphur (S)	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
COLLOIDAL.			
Cosan Colloidal Sulphur	50·0	Sulphur (S)	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
THALLIUM PREPARATIONS.			
A.C.F. Thallium Sulphate Bait	0·16	Thallium (Tl) as Thallium Sulphate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
WEED KILLERS—*See also* ARSENICAL WEED AND VERMIN DESTROYERS AND CHLORATE WEED KILLERS.			
2, 4–D.			
Nightingale 2–4 Di–Weed	70·0	2,4–Dichlorophenoxyacetic Acid	H. Blaiklock & Co. Pty. Ltd., 150 Mary street, Brisbane
Hardy's 2,4–D Powder	77·0	Sodium 2,4–Dichlorophenoxyacetic Acid	Brett & Co. Pty. Ltd., Grey street, South Brisbane
" Methoxone " Liquid	10·0	Sodium 4 Chloro, 2 Methyl Phenoxyacetate	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Dartormone 2,4–D Selective Weedkiller	80·0	2,4–Dichlorophenoxyacetic Acid	International Traders, 228 Roma street, Brisbane
Vallo 2,4–D Weedkiller	82·0	2,4–Dichlorophenoxyacetic Acid	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
" Mactaggarts " 2,4–D Liquid Hormone Weed Killer	50·0	2,4–Dichlorophenoxyacetic Acid in form of Sodium Salt	Mactaggarts P.P. Co-op. Assn. Ltd., Eagle street, Brisbane
" United " Selective Hormone Weed Killer	50·0	2,4–Dichlorophenoxyacetic Acid as Sodium Salt	United Chemicals Pty. Ltd., 91–7 Montague road, South Brisbane
Hormex 5X	50·0	2,4–Dichlorophenoxyacetic Acid	Wilcox, Mofflin Ltd., 68–70 Albert street, Brisbane
MISCELLANEOUS.			
Dinoc Selective Weedicide	30·0	Sodium–Dinitro–Ortho–Cresylate	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
ZINC SULPHATE.			
Zinc Sulphate	22·7	Zinc (Zn) as Zinc Sulphate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
Lightning Brand Zinc Sulphate	22·7	Zinc (Zn) as Zinc Sulphate	A. Victor Leggo & Co. Pty. Ltd., 185 Mary street, Brisbane
MISCELLANEOUS PREPARATIONS.			
Magnesite	46·0	Magnesium Oxide (MgO) as Magnesium Carbonate	A. C. F. & Shirleys Fertilizers Ltd., Little Roma street, Brisbane
Agricultural Tartar Emetic	75·0	Antimonous Oxide (Sb_2O_3) as Potassium Tartrate	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
Wilto Soil Treatment	3·0	Potassium Permanganate	A. G. Bignold & Co., 169 Elizabeth street, Brisbane
	0·5	Ethyl Mercury Phosphate	
	3·0	Paradichlorbenzene	
	12·0	Copper (Cu) as Copper Oxychloride	
	5·5	Phenols	
	64·0	Calcium Hydrate	
Larvacide	99·0	Chlorpicrin	Houghton & Byrne Pty. Ltd., T. and G. Building, Queen street, Brisbane
" Phosfone "	20·0	para–nitro–phenyldiethylthiophosphate	Imperial Chemical Industries of Aust. & N.Z. Ltd., 293 Queen street, Brisbane
Baxter's Dog Soap	10·0	Carbolic Acid	D. Maclean Pty. Ltd., 119 Charlotte street, Brisbane
E. 605 " Folidol " Extra Conc.	22·4	Diethylparanitrophenylthiophosphate	Pope, Mayne & Southerden, Pty. Ltd., 300 Adelaide street, Brisbane
Red Comb Potassium Permanganate	98·0	Potassium Permanganate ($KMnO_4$)	Poultry Farmers Co-op. Soc. Ltd., Roma street, Brisbane
Rawleigh's Louse Powder	0·58	Nicotine	Robinson & Bott Pty. Ltd., 459 Adelaide street, Brisbane
	8·42	Sulphur	
	8·5	Naphthalene	
Shell D–D Soil Fumigant	100·0	Chlorinated C_3 Hydrocarbons	The Shell Co. of Aust. Ltd., 301–7 Ann street, Brisbane
Tephos	95·0	Esters of Polyphosphoric Acids, including 20 per cent. Tetraethylpyrophosphate	Taubmans (Qld.) Pty. Ltd., 95 Edward street, Brisbane
Austral Dog Soap	3·0	Cresylic Acid	Taylors, Elliotts Pty. Ltd., 150 Charlotte street, Brisbane

F. B. COLEMAN,
The Registrar of Pest Destroyers.

The Young Farmer.

Club Activities.

The value of work done by many of the older Junior Farmer clubs in Queensland is reflected in the reports submitted at their annual meetings, which have been held at many centres already.

These meetings have been combined with social gatherings, with the result that the year ended for many clubs with sufficient funds in hand with which to start reference libraries, comprising text books on practical and scientific agriculture. These will be found of considerable use to club members when engaging in club and inter-club debates and discussions from time to time.

Several of the clubs' office-bearers have been replaced by other members, in order that these official positions might go round and so give more members an opportunity of becoming familiar with procedure at meetings, and with club activities generally. Among recent changes in this respect are: Tiaro (W. Day, secretary); Bauple (Basil Gee, secretary; Marie Goobanko, treasurer; and Victor Chapman, club leader); Biloela—Mt. Murchison (George Melonas, secretary); Murgon (Edna Zische, secretary) and Jambin (George Emmert, deputy club leader in place of Geo. Cowan, who has gone to New Zealand for 12 months to make a study of sheep raising in that country).

North Queensland Activities.

As a result of a recent visit to the Mackay district, following an earlier organising tour of North Queensland centres towards the end of last year, Mr. T. L. Williams (State Director) reports a growing interest in the work of that organisation in the sugar-growing areas of the State.

Three strong branches (or "clubs") were formed as a result of this latter visit—Sarina, North Eton and Eungella—with the foundation laid for others at Mackay and Proserpine at a later date. Membership forms have been forwarded to these centres, and as in the case of the other places visited, well-represented clubs are assured.

Canegrowers and dairymen attended in large force and evinced keen interest in the addresses delivered by Mr. Williams on the aims and objectives of the organisation. Club officials appointed at both Sarina and North Eton were all sons of local cane farmers, whilst at Eungella these positions will be filled by dairymen's sons when the election of office-bearers takes place at an early date.

Sarina officials were:—Club leader, C. Langdon; Deputy leader, Stewart Smythe; Secretary, T. Lawrie; and Treasurer, W. Edwards; with the following adults comprising the advisory committee:—Messrs. John Lawrie, E. Atherton, J. Langdon, S. H. Scougall, J. H. O'Neill, N. E. Goodchild, J. Webster and Councillor J. P. Jackson.

At North Eton, where there is already in existence a strong branch of the Junior Canefarmers' Society of Queensland, office-bearers are to be elected for the club from existing members who are within the prescribed age limit of 15 to 25 years set down by the Junior Farmers' organisation.

ASTRONOMICAL DATA FOR QUEENSLAND.

June.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.30	5.00	Cairns	8	50	Longreach	26	43
6	6.32	5.00	Charleville ..	25	29	Quilpie	37	33
11	6 34	4.59	Cloncurry	36	63	Rockhampton ..	1	19
16	6.36	5.00	Cunnamulla ..	31	27	Roma	15	19
21	6.38	5.00	Dirranbandi ..	22	16	Townsville ..	8	42
26	6.39	5.02	Emerald	11	28	Winton	29	52
30	6.39	5 03	Hughenden ..	21	[illegible]	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	5.29	7.06
2	6.33	8.15
3	7.42	9.17
4	8.49	10.09
5	9.53	10.52
6	10.53	11.29
7	11·49	Noon
		p.m.
8	..	12.29
	a.m.	
9	12.42	12.56
10	1.35	1.24
11	2.27	1.53
12	3.21	2 24
13	4.16	2.58
14	5.12	3.38
15	6.09	4.23
16	7.04	5.14
17	7.57	6.10
18	8.44	7.09
19	9.27	8 10
20	10 06	9.10
21	10·41	10.10
22	11.13	11.10
23	11.45	..
	p.m.	a.m.
24	12.17	12.12
25	12·52	1.15
26	1.31	2.21
27	2.17	3.30
28	3.10	4.42
29	4.12	5·53
30	5.19	6.58

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	30	9	46	24	21	0	54	26
6	24	14	40	29	15	4	46	33
11	15	24	30	40	6	16	35	47
16	9	30	25	45	0	21	26	54
21	14	23	30	39	5	14	34	45
26	26	13	43	29	18	3	50	32
30	30	9	46	23	21	0	54	26

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	55	3	68	32	51	18	45	4
3	54	3	67	32	51	18	44	4
5	45	10	61	37	46	23	37	10
7	34	21	54	44	38	29	29	18
9	29	31	50	52	35	37	25	27
11	20	41	43	58	28	44	17	35
13	10	50	37	63	22	49	9	42
15	3	56	34	67	18	53	4	46
17	2	56	33	67	17	53	3	46
19	8	48	36	62	21	48	8	40
21	18	38	42	57	27	42	16	33
23	28	27	50	48	34	33	24	23
25	41	20	57	44	42	29	34	18
27	52	8	66	36	50	21	43	8
30	56	2	68	32	52	17	46	3

Phases of the Moon.—Last Quarter, 7th June, 9.35 p.m.; New Moon, 16th June, 1.53 a.m.; First Quarter, 23rd June, 3.12 p.m.; Full Moon, 30th June, 5.58 a.m.

On 22nd June at 10 a.m. the sun will reach its greatest angle north of the equator. It will then rise and set 26 degrees north of true east and true west respectively. On the 9th and 23rd the moon will rise and set approximately at true east and true west respectively.

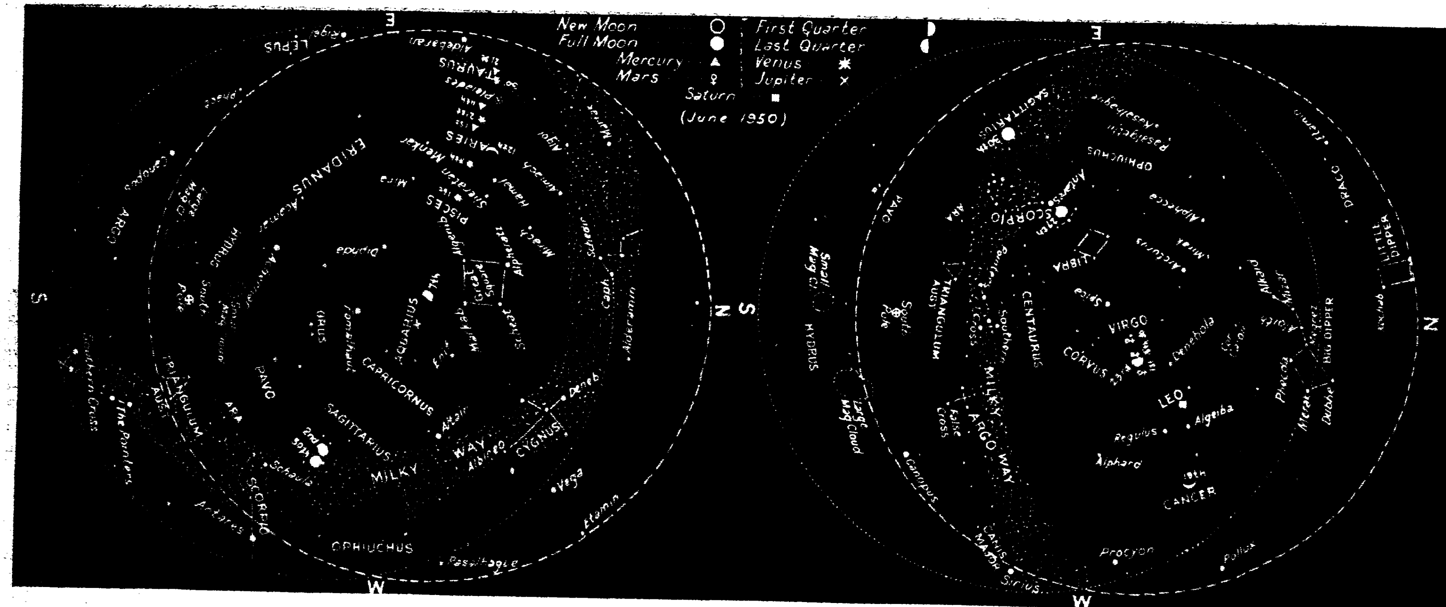
Mercury.—A morning object all this month. At the beginning in the constellation of Aries, it will rise 1¾ hours before the sun, reaching greatest angle west of the sun on the 10th. By the end of the month, in the constellation of Taurus, it will rise about 1 hour before the sun.

Venus.—Also in the constellation of Aries at the beginning of June, rising 3 hours before the sun. By the end of the month it will reach the constellation of Taurus and rise 2¾ hours before sunrise.

Mars.—In the constellation of Virgo, will be almost overhead at nightfall, setting about midnight. On the 23rd between 10 p.m. and 11 p.m. the moon will again pass in front of Mars.

Jupiter.—In the constellation of Aquarius, rising about midnight at the beginning of the month and between 9.30 and 11 p.m. at the end of June.

Saturn.—In the constellation of Leo about midway between Regulus and Mars. Setting about midnight at the beginning of the month and between 10 p.m. and 11 p.m. at the end of the month.



Star Charts.—The chart on the right is for 7.15 p.m. in the south-eastern corner of the State to 8.15 p.m. along the Northern Territory border on the 15th June. (For every degree of longitude we go west the time increases by 4 minutes). The chart on the left is for 10 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales border. When facing north, hold "N" at the bottom; when facing South hold "S" at the bottom; and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars, which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the moon and planets, which are continually changing in relation to the stars, are shown for certain marked days. When no date is marked, the position is for the middle of the month.

Volume 70 Part 6

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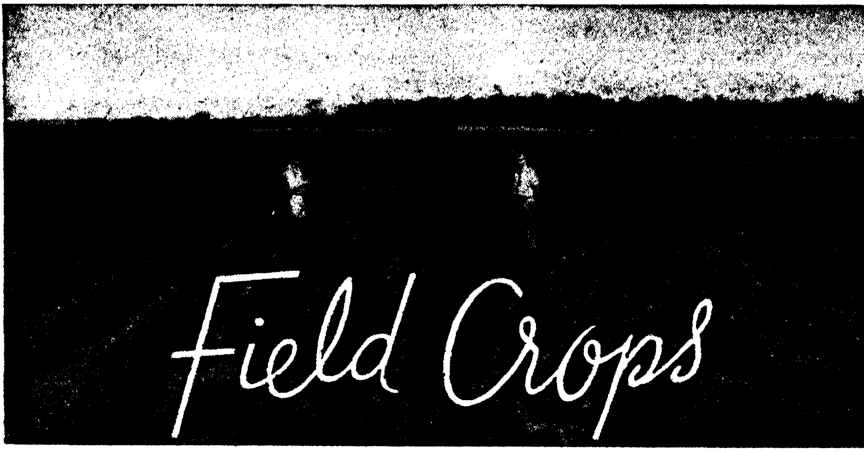


Wheat Growing in Queensland

C. S. CLYDESDALE (Senior Adviser in Agriculture) and L. G. MILES (Senior Plant Breeder).

THE story of wheat must be as old as that of civilised man. The crop is certainly known to have existed in a highly developed state amongst some of the earliest civilisations known to us today. It has even invaded, with conspicuous success, the formerly undisputed territory of maize in North and South America, and is the pre-eminent human food crop in the world. Two main reasons for its wide popularity are (i) its general superiority over other cereals for bread making, and (ii) its great adaptability to differing climates and soil types.

On account of the peculiar chemical and physical properties of the gluten within its flour, wheat is specially suited for the making of the soft bread with spongy cellular structure which is so popular amongst the more highly civilised races. Rye flour is also capable of making a fairly open-textured loaf; this, however, is regarded with much less favour than that of wheat. Most of the other cereal grains are incapable of producing a raised loaf of the texture of wheaten bread.

As regards its regional adaptability, wheat is now successfully and widely grown in each of the inhabited continents. While most of the major wheat areas of the world lie within latitudes 30 deg.-60 deg. North and 27 deg.- 40 deg. South, the crop has been successfully grown from the equator to the Arctic Circle. Moreover, it has been recorded from sea level to elevations of over 10,000 feet. Soil types on which the crop is commercially grown also vary widely, but the major world development has been on heavy black prairie soils such as abound in North America, Russia and the Argentine. On account of its wide distribution, this crop is being harvested in one country or another all the year round.

The two main broad groups which are commercially grown are (i) the bread wheats and (ii) of much lesser importance, the durum or macaroni wheats. The bread wheats also fall into two principal groups depending upon the season at which they are planted in the northern hemisphere. The "spring" wheats are normally used in countries in

which the winter temperatures are so severe as to prevent cropping during the winter months. These wheats are planted during the spring and harvested in the late summer. Where winter temperatures are less severe and where a sheltering layer of snow may be expected, "winter" wheats are usually sown. These are planted in late autumn, and the young plants at an early stage of development lie dormant through the winter, coming away again with the spring and maturing in midsummer or late summer. Normally the winter wheat group are higher yielding than the spring group because of their longer growing period and the opportunities for better development of their root system. In Australia, "spring" type wheats are universally grown, but owing to the relative mildness of our winter conditions, they are actually grown during the winter and spring months rather than the spring and summer months.

In Table 1, the approximate annual wheat production for the world's ten major producing countries is shown, first for the 1935-39 period and second for the year 1947.

TABLE 1.*

WHEAT PRODUCTION IN SELECTED COUNTRIES.

Producing Country.	Approximate Annual Yield. (millions of bushels.) 1935–39.	1947.
United States of America ..	760	1,400
China	750	900
Russia	1,250	900
Canada	310	350
India and Pakistan.. ..	400	300
Australia	150	220
Italy	280	200
Argentina	220	170
France	300	150
Turkey	140	130

* Source : F.A.O. Commodity Series No. 10, Jan., 1949.

While Australia ranks somewhat low in production amongst the first ten wheat producing countries, it normally exports a comparatively high percentage of its total yield, thus making it one of the world's leading exporters of wheat. Exports in 1947-48 totalled 60 million bushels of wheat and 780,000 tons of flour; the bulk of the wheat went to England and India, while the principal importers of Australian flour were Ceylon and Malaya.

WHEAT IN QUEENSLAND.

Although Queensland ranks only fifth amongst the Australian States in its wheat production, this crop has developed to the stage at which it is second only to sugar cane among the cultivated crops in annual value to the State. Up till about 1938, Queensland's production was insufficient to meet local requirements, and grain was imported every year from southern States. With expanding production in post-war years imports have been considerably reduced, and in 1949 Queensland joined New South Wales, Victoria, South Australia and Western Australia in entering the export field.

The factors restricting the growth of the industry in Queensland (as compared with southern States) have been mainly climatic. A considerable belt of southern Australia receives the bulk of its rainfall

during the winter and spring months and enjoys warm dry weather in midsummer—ideal conditions for the growth and maturity of a winter-planted crop. In Queensland the reverse normally holds; the winter and early spring months are normally the driest in the year, while the harvest months of October-December are frequently characterised by violent storms. With such weather hazards early development was sporadic and subject to frequent set-backs. The comparative success which the industry has subsequently attained has been due largely to (i.) the perfection of the summer fallowing technique, (ii.) the breeding of varieties suited to the environment, and (iii.) the development of power farming methods.

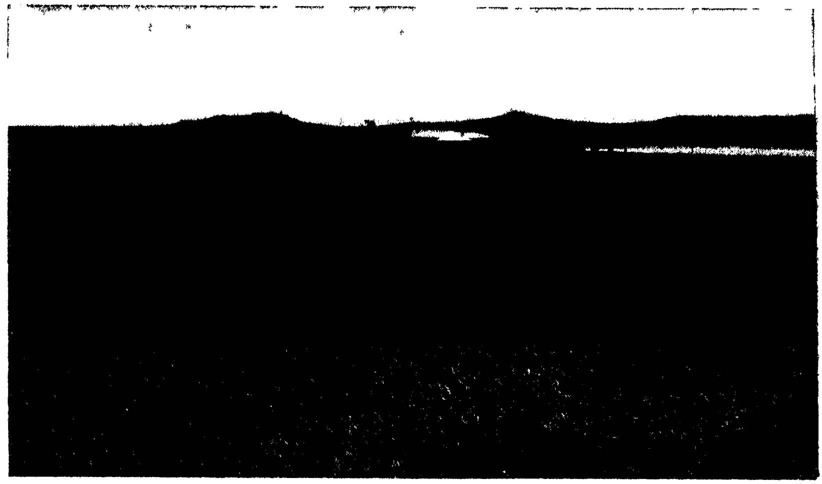


Plate 140.

A Field of Puora Wheat on the Darling Downs.

The purpose of the summer fallow is to entrap as efficiently as possible the heavy summer rains and to retain the moisture within the soil for the benefit of the succeeding winter crop. With ample subsoil moisture stored, all that is required is a useful planting rain during the May-July period to enable the crop to be established with a good chance of success. Crops of over 30 bushels per acre have been obtained on well fallowed land, even in Central Queensland, with no effective rainfall subsequent to planting.

The early selection of varieties for the State was somewhat fortunate in that it included varieties of early maturing habit, relatively low water requirements, and very satisfactory grain quality. The quick ripening of such varieties enabled them to escape many of the hazards of the early summer thunderstorm period, including that of loss through rust. A breeding programme extending over some fifty years has kept these objectives in view and has contributed very materially to the expansion of the industry in this State.

The development of power farming methods has enabled individual farmers to handle considerably larger areas. In addition, by speeding up the operations of land preparation, planting and harvesting, it has greatly increased the safety factor in districts in which the weather conditions are normally unpredictable and often decidedly unfavourable.

The sound progress made by the industry in Queensland is reflected in the fact that, despite occasional seasons in which the crop is almost a total failure, the average grain yield per acre is higher than that in any of the four major wheat producing States, and the grain quality is acknowledged to be well above Australian average. Some idea of the development which has occurred during the last 30 years is provided by Table 2, giving areas sown, total yields of grain, and mean yields in bushels per acre.

TABLE 2.

ANNUAL WHEAT PRODUCTION IN QUEENSLAND.

Year.	Area.	Production.	Yield per Acre.
	Acres.	Bushels.	Bushels.
5-year average, 1920–24	145,555	2,326,904	15·99
1925–29	172,068	2,577,427	14·98
1930–34	244,986	3,980,630	16·25
1935	239,631	2,690,316	11·23
1936	283,648	2,016,236	7·11
1937	372,935	3,749,443	10·05
1938	442,017	8,583,736	19·42
1939	362,044	6,794,906	18·77
1940	322,081	5,687,350	17·66
1941	290,801	3,079,898	10·59
1942	334,785	5,005,065	14·95
1943	281,302	5,084,292	18·07
1944	332,365	6,980,766	21·00
1945	392,502	8,187,687	20·86
1946	247,996	704,835	2·84
1947	462,239	10,684,563	23·11
1948	607,750	14,317,422	23·56
1949	670,000*	11,500,000*	17·16*

* Preliminary estimate only.

For further details of the development of the wheat growing industry in Queensland, reference should be made to the *Queensland Agricultural Journal* for June, 1949 (pp. 364-370) and July, 1949 (pp. 39-55).

QUEENSLAND WHEAT-GROWING DISTRICTS.

The Darling Downs division has always provided the bulk of the State's wheat grain crop. During the 1948 season this division was responsible for 95 per cent. of the total Queensland production. Details of areas and yields for the wheat growing districts of the State for the 1948 season are listed in Table 3.

TABLE 3.

WHEAT PRODUCTION BY DISTRICTS.

District.	Area.	Production.	Yield per Acre.
	Acres.	Bushels.	Bushels.
Darling Downs	563,257	13,593,270	24·13
Maranoa	21,076	303,570	14·40
Port Curtis	9,610	172,698	17·97
Wide Bay and Burnett	9,342	170,727	18·28
Moreton	3,585	76,485	21·33
Central and Far West	880	672	0·76
Total	607,750	14,317,422	23·56

On the Darling Downs the chief producing centres are Dalby, Pittsworth, Jondaryan, Clifton, Millmerran, Warwick, Allora and Cambooya. The older centres are those on the eastern Downs served by the main railway line from Toowoomba to Warwick. During the past 30 years there has been a steady westward trend of the centre of production to the vast open plains country stretching from Pittsworth through Cecil Plains to Dalby and the Jimbour Plains. The Darling Downs division embraces what is certainly the safest area for the further expansion of the industry.

In the Maranoa, wheat has been grown with varying success since 1882. For many years the acreage devoted to this crop fluctuated very little, but of recent years there has been a slight but steady increase. This district was served from 1906 to 1935 by the Roma State Farm, where Mr. R. E. Soutter's wheat breeding programme was centred.

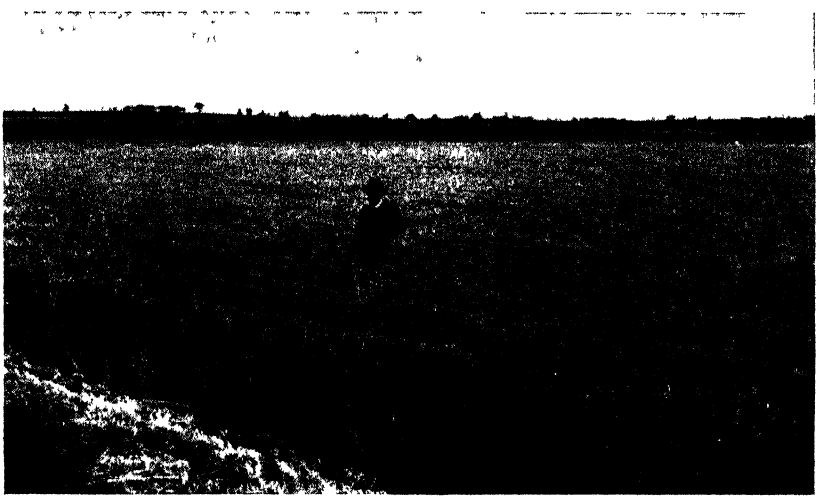


Plate 141.

A Field of Seafoam Wheat at Allora, Darling Downs

In the Port Curtis division wheat is grown on farms of medium size as an adjunct to dairying and pig raising. While rainfall recordings in this division are similar to those at Darling Downs centres, the evaporation rate is markedly higher and the risks attending crop production are correspondingly greater. In favourable years, however, excellent yields of good quality grain have been recorded, and the area devoted to wheat has more than doubled in the past eleven years. While this district contains a large additional area of potential wheat land and probably will expand its production considerably, it cannot be regarded as a safe area for grain production alone.

In the other districts listed, wheat growing is normally a minor sideline on dairy farms or mixed crop farms of relatively small size, and cannot be expected to expand to any major extent.

SOIL TYPES SUITABLE FOR WHEAT GROWING.

Where satisfactory moisture is available, wheat can be grown successfully in Queensland on most types of soil, ranging from light loams to the red scrub soils of the South Burnett and the heavy black

clay soils typical of the western Darling Downs. While the lighter textured soils may have definite advantages in certain seasons, it is on heavy clay soils that the bulk of the State's crop is produced.

The heavy black soils of the Darling Downs possess a high clay content which endows them with an excellent moisture holding capacity and renders them ideally suited for fallowing. Since wheat growing in Queensland depends very largely upon the success of the summer fallow, the heavier soils are generally regarded as the safer soils in areas in which an ample summer rainfall can be conserved.

Where crops have to depend mainly on the rainfall received during the growing period, lighter soils may well give better results. Winter rains in this State are often in the form of light showers which could benefit a sandy loam soil but have little effect upon a heavy clay soil. During seasons of light but frequent winter rains at the Roma State Farm, yields were invariably higher on the lighter soils than on the heavy clay loams. As seasons cannot be forecast, however, little advantage can be taken of this knowledge. Since the whole of Queensland experiences a predominantly summer rainfall, it is logical to assume that any further expansion in wheat growing will be based upon the summer fallow, and will therefore be associated with the heavier types of soil.

Up to the present, there have been virtually no responses to standard fertilizers on the bulk of the Queensland wheat soils. Unlike the soils of much of the wheat belt in southern Australia, the soils of the Darling Downs were well supplied initially with phosphorus and other plant foods. There are recent indications, however, of phosphate deficiency in some of the lighter textured soils fringing the Downs proper and on some of the eroded slopes on the eastern Downs; such soils will respond to regular applications of superphosphate. Moreover, with repeated years of cultivation, even the most fertile of the wheat soils may eventually be denuded of some of the essential plant foods and will then require fertilizing to produce good yields of high quality wheat.

MACHINERY REQUIRED.

There is no crop which can show greater and more revolutionary changes in the machinery and implements used for its production during recent times than wheat. For instance, about 40 years ago, a farmer with 80 acres of suitable land on the eastern Downs, possessing three horses, their harness, a single furrow plough, a set of harrows, and a reaper-and-binder was considered sufficiently well equipped to take up wheat growing. Today, the position is very different, and a heavy outlay is required to purchase an up-to-date plant such as is essential to successful wheat culture. The fact that the chances of success have been much enhanced by the use of modern machinery is, however, an important compensating factor.

The machinery required for wheat production will, of necessity, include the following equipment, the size and number of the various implements depending on the area under crop:—tractor; sundercut; scarifier; harrows; combine; header-harvester; roller (for some areas); and a medium size motor truck. In addition to these items it is also desirable to have a well equipped farm workshop so that repairs can be rapidly effected during the critical planting and harvesting periods.

The estimated cost of a single unit plant containing the above implements would in 1950 be in the vicinity of £3,000, and accordingly it is imperative that these implements receive the best of care. If possible, all machinery should be kept under cover when not in use, and implements should be painted and repainted as required, especially the wooden parts.

On the completion of harvesting or of any other major operation, all machinery before being housed should be thoroughly overhauled for worn, cracked or broken parts, and the required duplicates ordered so that they can be used to replace those defective parts when a slack or wet period occurs. By adopting this procedure, delays occasioned by breakdowns can be reduced to a minimum.

CULTURAL METHODS.

Throughout the main wheat growing areas of the Darling Downs, the universal practice is to grow a crop of wheat each season. It has proved economically sound, where modern machinery and high powered tractors are available, to carry out cultural operations in a manner that will conserve the summer rainfall for use by the following winter crop.

While the surface soil is important in providing the plant nutrients, the subsoil is of particular importance to the wheat grower as a moisture reservoir to carry the crop through the winter months. Moisture and not soil fertility has been the factor limiting the successful growing of wheat throughout the greater part of the wheat growing area. Adequate subsoil moisture can usually be stored during the summer by means of the short clean fallow.

On the western Darling Downs and in the Maranoa, where the rainfall is less, the adoption of the long fallow in conjunction with the short fallow is considered advisable. The value of the long fallow in these two districts was demonstrated by an experiment in which a yield of 24 bushels to the acre was obtained from a 30-acre field worked thus, on a rainfall of under 2 inches during the growing period of nearly six months, whereas that secured on the short-fallow section was only 17 bushels to the acre.

These yields were obviously not produced solely on the rain experienced during the growing period, but were obtained through the moisture and plant foods that had been conserved previously in the soil. Investigations have demonstrated that, under natural conditions, 7½ inches of water are required to pass through a wheat crop to produce 25 bushels of grain per acre. Hence, even supposing the whole quantity which fell as rain were available for the use of the crop, it was necessary for the moisture reserves of the soil to provide the equivalent of approximately a further 5½ inches of rainfall for the 24-bushel crop to be realised.

No hard and fast rule can be laid down regarding the conservation of the necessary soil moisture, for the controlling factors are many. The individual grower must, therefore, decide as to the most desirable course to pursue to meet the requirements of his own particular case.

Fallowing.

The difference between a long and a short fallow is that with the former the land is cropped every second year with wheat, and during the interim is worked with the object of conserving the maximum

amount of moisture in the soil from the rains that occur. The short fallow, on the other hand, is sown to a winter cereal every year, the first cultural operation following immediately harvesting has been completed in November or December. With the adoption of a system embracing the long and short fallow, it is advisable to apportion the area to be cropped into three equal sections, two of which will be sown during the first season on a short fallow, the third being worked but not sown until the following year, thereby constituting the first cropped long-fallow area In the second year one of the two previously planted sections will again be sown, constituting the short-fallow portion of the crop; whereas the balance will constitute next season's long-fallow block. As a result of this procedure, two-thirds of the area devoted to wheat will be cropped every year, half of which, after the first year. will be on long fallow and half on short fallow.

The long-fallow practice in Queensland might be objected to on the grounds of the cost of maintenance of a clean fallow through two summers as well as one winter. However, sheep raising as an adjunct to wheat growing provides a means of controlling weed growth during periods of the long fallow. Wild oats and other winter weeds can also be controlled under such a system.

Treatment of Stubble.

The burning of stubble subsequent to harvesting has been widely practised throughout the Darling Downs. While this practice is known by farmers to be contrary to the soundest agricultural principles, its wide use is based upon ease of subsequent cultivation and upon the absence of evidence of any resultant falling off in yield. In areas in which crops have been tall and a heavy stubble has been left,

Plate 142.

Discing of Heavy Stubble Without Burning.—This is being undertaken on sloping land as a measure to protect the soil from erosion.

considerable difficulty may be encountered, with the machinery available, in preparing a fallow with satisfactory moisture conserving mulch. Under such conditions particularly, the temptation to burn the stubble has been very great.

The principal arguments against stubble burning are (i.) that it robs the soil of a potential annual source of organic matter which would help to maintain a good soil structure; and (ii.) that it destroys the surface cover and renders the soil more subject to erosion during the heavy rains of the summer period. The burning of the crop residues is a particularly unwise procedure on unprotected slopes. If stubbles cannot be retained and satisfactorily worked upon such slopes, the land should not be used for wheat or any other winter crop which requires the soil to lie bare during the wet season.

The principle of stubble-mulching has recently been developed in America, and may find a useful application in Queensland, particularly on slopes which are subject to erosion. The practice involves the use of special cultivating equipment which stirs up the subsurface soil but leaves the straw on the surface as a soil-protecting mulch (Plate 142). Certain difficulties may arise in the application of such methods—for example, in the complete control of weeds during the stubble-mulch period, and in planting (should residues of straw still remain on the surface at planting time). For these reasons, stubble-mulching, while regarded as being very sound in principle, cannot be universally recommended until the technique of its operation has been worked out in Queensland and until satisfactory results to both soil and crop have been demonstrated.

Land Preparation.

While a multiple disc or mouldboard plough (more frequently the latter) is required to bring virgin land into condition for wheat growing, the subsequent use of the plough is seldom necessary on established Downs wheat farms. A disc cultivator, scarifier, combine drill and harrows are the implements normally used in preparation of land for wheat. Implements are selected for size and width of cut in accordance with the horse-power of the tractor employed. Where wheat is grown in rotation with other crops on mixed farms or dairy farms, the initial cultural operation will almost certainly require to be a ploughing to dispose of row crop residues, grass, weeds, etc. Ploughing may also be a necessity upon soils of poorer structure than the typical wheat soils of the Darling Downs, in order to open up the land for satisfactory penetration of summer rains. Such ploughing is frequently carried out by means of multiple-disc cultivator-ploughs of the "sundercut" type (Plate 143).

As cultural operations are carried out during the summer months when heavy rains are frequently experienced, soil erosion is an important factor to be considered, particularly on sloping or undulating country. Fortunately, most of the open plain country, on which a high percentage of Queensland's wheat is produced, is very flat and relatively safe from erosion. Where erosion is likely to occur, cultivation should follow the level contours of the field in order to minimise loss of soil and increase moisture-trapping capacity.

Once harvesting is completed, it is essential to work the land as soon as possible to make it receptive of summer rains. The condition of the soil will of course determine the period at which this first cultivation can be carried out, but conditions are usually favourable as soon

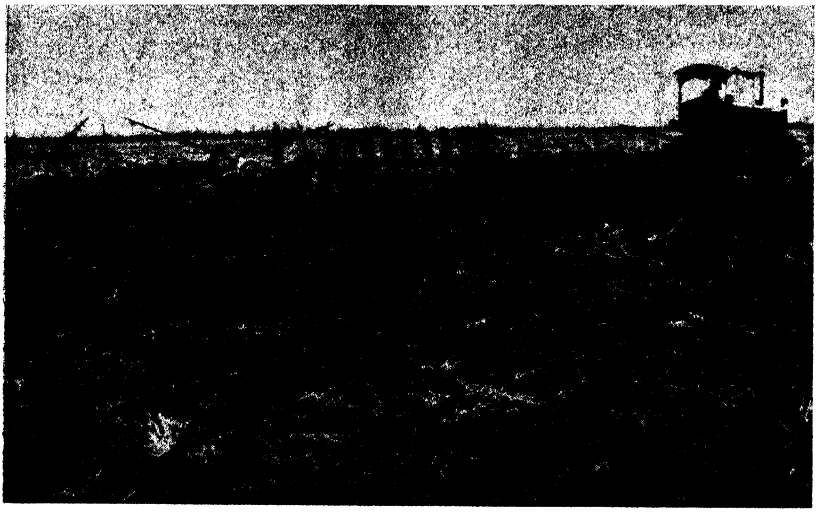


Plate 143.

Initial Preparation of Land.—A heavy tractor is pulling three disc-cultivator-ploughs of the "Sundercut" type.

Plate 144.

Working the Fallow on a Mixed Farm by Means of a Light Tractor and "Combine."

as the land will carry a tractor satisfactorily after rain. It is then necessary to complete the operation as rapidly as possible before the land becomes too hard for working. Deep cultivation is generally regarded as unnecessary and even undesirable for wheat. The initial cultivation need not exceed 5 inches, with later operations aiming at the establishment of a firm seed-bed at 2 to 3 inches from the surface. After the first cultivation the surface is allowed to lie in a rough state until rain has fallen, when harrowing will normally reduce the soil to a favourable tilth

All tillage operations are then directed towards moisture conservation by the elimination of weeds and the provision of a loose surface mulch. The breaking of the surface crust leaves the soil in a condition which is receptive of rainfall, and so promotes maximum penetration. The mulch also provides insulation for the moist subsurface soil, and minimises evaporation. This protection is particularly important in clay soils which tend to crack during hot dry periods, and hence lose further moisture from the deeper layers.

The implements used to create and maintain a surface mulch will depend largely on soil conditions and weed incidence. It is not wise to use a disc cultivator when a tine implement (Plate 144) will do the job. Tined implements have the advantage of disturbing the surface soil without unnecessary inversion and undue loss of moisture, and at the same time creating an even seed-bed. It is, however, self-evident that where weeds have become firmly established, such as following a continued wet period, the disc cultivator is the logical implement to use. The use of the harrows soon after rain, while weeds are small, frequently saves the use of more expensive modes of cultivating.

The number of times it is necessary to work a field will vary considerably with the season. While it is necessary that a high percentage of all summer rains should be held, this is especially so in the case of the normal heavy rains of February and March.

Surface Mulch.

Observations made over a lengthy period on a wide range of soils in different parts of Queensland indicate that 2½ to 3 inches is the ideal depth of mulch. Shallower depths are not as effective and a deep mulch is not only a waste of time but is harmful in a season of low rainfall.

The recommended depth provides a firm moist seed-bed just under the seed at planting and this encourages a quick even germination which is desired by wheat growers. The black earth soils of the Darling Downs fortunately have a "self mulching" tendency which facilitates working and the preparation of a satisfactory seed-bed.

VARIETIES.

A steady and continuous change has occurred in the list of varieties holding premier place in the State's wheat culture. Many hundreds of varieties from many parts of the world have been tried by farmers under field conditions during the history of the industry here. It gradually became evident, however, that the varieties offering best prospects of a successful grain crop were early maturing varieties, and preferably those with a light foliage and stemmy rather than leafy appearance. The early maturing habit conferred a certain drought resistance, since varieties of this type required less moisture per unit

of grain yield than did later maturing types. This characteristic was especially important in the earlier days of the industry before the short or summer fallow was as efficiently practised as it is today. Another major advantage of the early maturing varieties was that they were in most seasons able to mature their crop before rusts became prevalent enough to seriously threaten yields. Such varieties, while certainly not rust-resisting, were frequently rust-escaping.

The breeding programme, commenced by Mr. R. E. Soutter before the beginning of the century and continued by him until his retirement in 1948, had as its major objectives (i.) drought resistance, (ii.) high bread-making quality, (iii.) rust resistance, and (iv.) general adaptation to local conditions. Considerable success was achieved in objectives (i.), (ii.) and (iv.) within a period of 25 years, and the important westward movement towards Dalby of the centre of wheat production has been attributed by farmers themselves to be largely the result of the liberation of Soutter wheats. Rust resistance was not successfully introduced into commercial wheats until quite recently, mainly because no suitable rust-resisting parents were available in the earlier years of the century. The liberation of Three Seas represented a distinct advance in rust resistance at that time, but a high degree of field resistance has not been achieved until the last decade It is intended that all new varieties made available to farmers in Queensland shall now possess rust resistance (particularly stem-rust resistance) in addition to yielding ability, high quality and general adaptability.

In the late 1920's the three leading varieties in the State were Pusa-4 (from India), Florence and Clarendon (both from New South Wales); these three held pride of place until 1932. In 1933 and 1934 Florence, Flora and Three Seas were the leading varieties, and Queensland-bred wheats were beginning to play an important part; these three wheats dominated the scene until 1939, when Florence's popularity began to wane and Puora reached a prominent position. Puora became the most popular variety in 1941 and has retained this position up till the present time. In Table 4 are listed the 12 most popular varieties during the 1948 season together with their acreages both for that season and for the preceding season.

TABLE 4.

ORDER OF IMPORTANCE OF MAIN VARIETIES.

Variety.	1947 Area.		1948 Area.	
	Acres.	Per cent.	Acres.	Per cent.
Puora*	128,501	26·5	104,857	16·7
Three Seas †*	55,820	11·5	72,070	11·5
Puseas*	49,561	10·2	69,724	11·1
Gabo	8,517	1·8	58,106	9·2
Charter	10,183	2·1	53,000	8·4
Puglu*	45,477	9·4	52,070	8·3
"Fedweb-5"	20,754	4·3	49,230	7·8
Puno*	51,759	10·7	38,459	6·1
Warput*	16,095	3·3	22,339	3·5
Kendee	1,541	0·3	21,799	3·5
Ford	17,343	3·6	9,205	1·5
Florence x College*	881	0·2	8,205	1·3

* Queensland bred variety.

† Including Seafoam.

While in recent years over 80 per cent, of the State's wheat acreage has been occupied by Queensland-bred varieties, there is a marked present trend towards rapid increase of New South Wales stem-rust resistant varieties such as Gabo and Charter. As new rust resistant varieties from the Queensland breeding programme are made available for general distribution, it is anticipated that such rust resistant types will eventually dominate the field.

Brief descriptions and actual-size illustrations of the more important varieties grown in Queensland follow, the varieties being listed alphabetically. The majority of these varieties are either widely used or recommended at the present time; a few, such as Florence, Flora and Pusa-4, while little grown today, have been included for reasons of historical interest.

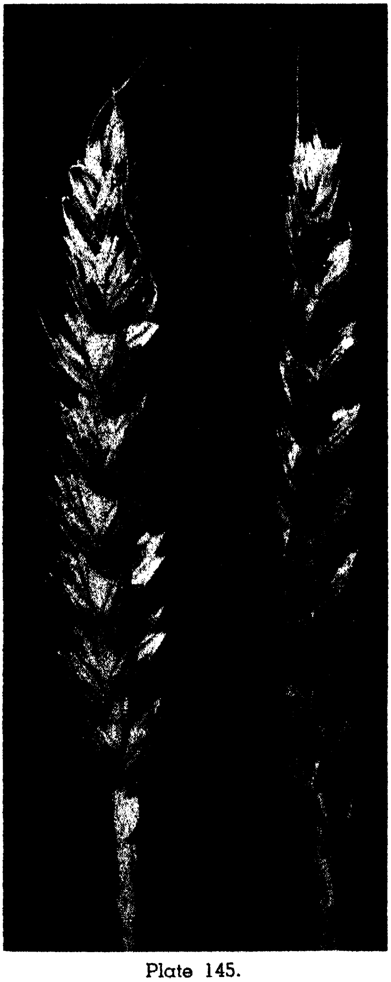


Plate 145.
Celebration.

Plate 146.
Charter.

Celebration.

This is a stem-rust resistant variety developed by the New South Wales Department of Agriculture at Glen Innes. It is little grown in Queensland as yet, and being late maturing like Ford, cannot be

generally recommended for main-season planting. Ears (Plate 145) are loose and tapering, with a medium tip awn and smooth brown chaff. The variety is fairly tall, like Ford, and susceptible to leaf-rust, but is highly resistant to stem-rust. Grain is of fairly high gluten quality. Its main use will be as a stem-rust resistant variety for early planting, and possibly also as a hay or grazing wheat.

Charter.

Another new rust resistant wheat from Glen Innes, N.S.W., this is a fairly tall variety with attractive straw and slightly tapering, well filled ears (Plate 146) which are white chaffed and prominently tip-awned. Charter is mid-early to midseason in maturity, highly resistant to stem-rust and moderately susceptible to leaf-rust. When ripened under favourable conditions the grain is very attractive, smooth and vitreous, with high gluten quality. When carrying a heavy grain crop the straw is apt to lodge from the base, but since there is no tendency to break or tangle, no difficulty is normally experienced in harvesting. Charter has shown itself well adapted to hot ripening conditions, and produces a well finished grain even in Central Queensland, where southern varieties frequently pinch rather badly. This characteristic, together with its rust resistance, suggests its usefulness for spring planting in years in which the winter planting rains have been unsatisfactory. It is also being sown quite generally as a main-season variety on the Darling Downs. Evidence from northern New South Wales in the 1949 season suggests the appearance of a new form of stem-rust to which Charter is quite susceptible. The future rust resistance of this variety is therefore in some doubt, and will require to be carefully checked during the next few seasons.

"Fedweb—5."

This variety is another of the rust resistant group which has spread into Queensland from New South Wales. Unfortunately, it has, in passing through farmers' hands, acquired an incorrect name. It has recently been ascertained that the variety known in Queensland as Fedweb-5 is not truly a Fedweb at all, but is almost certainly a strain of similar parentage to Gabo. The wheat is very similar in all its field characteristics (including rust reaction) to Gabo. The only distinguishing features are the usually taller growth (by 3 to 6 inches) and later maturity (by 4 or 5 days) of "Fedweb-5." The variety, like Gabo, is capable of very good yields under favourable conditions, but Gabo has generally proved somewhat the better of the two, and would certainly be preferred for medium-late or late sowing. Another variety known as "Fedweb-7" is easily distinguished from "Fedweb-5" by its brown chaff; though grown to some extent on the Darling Downs, it has proved less popular than "Febweb-5."

Flora.

This variety is now little grown in Queensland, having been superseded largely by Puora. At the time of its liberation, however, it represented a distinct advance in breeding for Queensland conditions. A wheat of good grain quality, it won international prizes, and was very prominent in Queensland wheat culture for 20 years. The variety is early maturing, erect, with medium-tall straw; ears (Plate 147) are of medium size, lax, completely bald, with smooth white chaff. The grain is very distinctive, being small, shotty and very vitreous. Flora is very susceptible to both leaf-rust and stem-rust, and has in occasional bad rust years produced very pinched grain.

Florence.

One of Farrer's wheats, this has played a prominent part in Queensland from the early years of the century right up to 1938, about which time it was superseded as leading variety by Flora. Florence is an early maturing variety with medium-tall straw and ears having white chaff and tip awns. The variety has always been free-shelling, resulting sometimes in shattering in the field and sometimes in excessive weathering of the grain. Though this variety has been a very reliable one for many years, there is little to recommend it now in preference to a number of more recent varieties. Florence, like Pusa-4, has played a very important part in the breeding of modern varieties and strains.

Plate 147.
Flora.

Plate 148.
Florence x College.

Florence x College.

This crossbred selection, which it is hoped to liberate under the name of Lawrence, was derived from a cross between Florence and a highly rust resistant variety known at the time as "College," but almost certainly the North American variety Hope. This selection, made in

1938, has been widely tested and has proved to date the most rust resistant wheat in Queensland under field conditions. The variety is moderately tall, with fairly fine attractive straw of good strength. It is mid-late to late in maturity, averaging perhaps a little earlier than Ford. Ears (Plate 148) are of small to medium size, tapering and slightly inclined, with small tip-awns seldom exceeding ¼ in.; chaff is smooth and creamy white. The grain is of medium size and light colour, and is semi-translucent, yielding a flour of very satisfactory gluten quality. This variety is highly resistant in the field to both stem-rust and leaf-rust; it has also shown better cold resistance than most Queensland varieties and has proved itself a useful grazing wheat. When planted

Plate 149.
Ford.

Plate 150.
Gabo.

as a main-season variety it is capable of useful yields, but would not be expected to compete successfully with a number of the standard early-maturing varieties. It is recommended chiefly as a substitute for Ford for early planting; its rust resistance and cold resistance give it an advantage over Ford and its palatability makes it ideal for feeding off. The variety is also recommended for trial in coastal districts as a hay or grazing wheat.

Ford.

This South Australian wheat has been grown to a moderate extent for over 20 years, and attained its maximum popularity between 1937 and 1943. It is a late-maturing variety which proved suitable in most years for early planting for green feed, hay or grain. It was used considerably as a dual purpose wheat capable of producing useful grain yields after feeding off. In this class it has largely been superseded by Warput, and now rust-resistant wheats such as Florence x College and Celebration are available to take its place. Ford is a tall, yellow-strawed variety with a particularly long, loose, tapering ear (Plate 149) with prominent tip-awns. Its grain is large, yellowish and of medium gluten strength.

Gabo.

One of the outstanding modern Australian wheat varieties, this wheat, which was bred by Sydney University, combines high yielding ability with good quality, good field characteristics and stem-rust resistance. It is short, well stooled, strong strawed and early maturing, with fairly short ears (Plate 150) having light coloured chaff and strong tip-awns. While it is very highly susceptible to leaf-rust, it has shown itself capable of high yields in spite of heavy infestation by this disease. Its grain is of low bushel weight, but, while frequently of poor appearance owing to a dull and wrinkled bran, has proved itself capable of producing a bread flour of high quality and good balance. In recent tests, Gabo has proved its outstanding yielding ability at a number of centres on the Darling Downs, particularly in the eastern and central sections. It cannot be recommended for general planting in hotter districts, where it often finishes badly, or in coastal areas, where it has proved highly susceptible to scab. It is recommended for June or July sowings throughout the eastern and central Downs. On account of the recent appearance of new races of stem-rust, Gabo's resistance to this disease is now in question. In the 1949 season, Gabo on the eastern Downs was still highly resistant to stem-rust, but reports from northern New South Wales and the western Downs claimed that the variety had on occasions been seriously rusted.

Kendee.

This is another of the rust resisting wheats developed recently by Sydney University plant breeders. It is a wheat of medium height and strong straw; heavy crops have, however, been known to lodge severely like those of Charter. Ears (Plate 151) are fairly compact, with yellow chaff, and tip-awns up to 1 inch in length. In Queensland it is mid-early to midseason in maturity, and capable of high yields, particularly under good conditions. Its grain is large, slightly wrinkled and dull, but mainly vitreous, and yielding a flour of medium-strong class. Kendee, like Gabo, is highly susceptible to local forms of leaf-rust, but has in the past proved to be fairly resistant to stem-rust, being in this respect somewhat inferior to Gabo and Charter. The variety appears to be well suited to midseason planting on the Darling Downs, but would not be generally recommended for planting further north or west.

Plate 151.
Kendee.

Plate 152.
Puno.

Puno.

This Queensland-bred variety has the parentage Pusa-4 x Novo. Puno is very similar in its general growth to the more widely grown variety Puora, but on ripening develops a brighter, yellower colour in the straw and chaff. Puno is an early-maturing variety with sparse foliage and moderately tall straw; in most seasons it averages 3 inches taller than Puora. Straw is reasonably strong, but the variety frequently lodges seriously from the base. Ears (Plate 152) are medium-small, tapering and slightly open, characterised by smooth creamy chaff and very short (often hook-shaped) tip-awns. Puno is susceptible to both leaf-rust and stem-rust, but even under conditions of fairly general attack is able to mature a plump grain sample. The grain is normally of medium size, smooth, amber coloured, vitreous, and of high bushel weight and pleasing appearance. Its high gluten quality places it in the strong flour class. Puno has yielded well under a variety of conditions, and should be a useful variety for midseason or late planting in any of the inland wheat districts.

Plate 153.
Puora.

Plate 154.
Puseas.

Puora.

The present standard Queensland variety, Puora occupied 105,000 acres in 1948, and has been in first position since 1941. The variety is derived from a Pusa-4 x Flora cross made at Roma State Farm in 1926; the selection from which the variety was derived was made in 1932 and named in 1936. Puora, like most Queensland-bred wheats, is early-maturing and carries a very light foliage (Plate 140). Height is medium to medium-tall, and straw and glumes are a dull creamy white. Straw is of moderate strength, and though the variety lodges occasionally, it is no worse than average in this respect. Ears (Plate 153) are of small to medium size, tapering, and very open when viewed from the side; the chaff is smooth and tip-awns are absent, making this one of the few common varieties which are completely bald. Grain is medium-small to medium in size, shorter and broader than that of Puno and closer to white in its colour; its texture is normally vitreous, and it yields a flour

of strong gluten quality. While Puora is fairly susceptible to both stem-rust and leaf-rust, it is able in most seasons to escape serious injury. Puora is a very reliable "main-crop" variety for general sowing, both on the Downs and in outlying districts. It appears to be better adapted to the central and western Downs than to the eastern fringe.

Pusa-4.

Pusa-4 is an early importation from India, which has generally been regarded in Australia as the standard of highest (or premium) gluten quality. Like Florence it was prominent in Queensland wheat culture for over 20 years and is still grown on some thousands of acres today. It is an early maturing, medium-tall variety with a somewhat open, bald, tapering ear with densely pubescent glumes (velvet chaff). It is very susceptible to rust, but otherwise is well suited to Queensland conditions even as far north as the Tropic. It has been widely used as a parent of many of the State's highest quality wheats.

Puseas.

Derived from a cross between Pusa-4 and Three Seas, Puseas was distributed in 1936 and named in 1939; since 1942 it has been one of the five leading varieties in the State. It is early to mid-early, being normally a few days later than Puora. Straw is medium-tall (usually 2 to 3 inches taller than Puora) and of medium strength. Ears (Plate 154) are tapering, slightly inclined and moderately dense, with smooth white chaff and tip-awns, one or two of which are prominent and up to ½ inch in length, the remainder short and hooked. The grain is large and plump, semi-translucent, often with slightly wrinkled bran; its flour quality places it in the strong to medium-strong class. Puseas is moderately susceptible to leaf-rust but possesses good field resistance to stem-rust, though by no means immune to this disease. Puseas has yielded well, particularly on the central Downs, and should be a useful main-crop variety for that district.

Seafoam and Three Seas.

These two varieties, which are virtually indistinguishable in field characteristics, are both selections from the same cross, Comeback x Cretan x Comeback. Major purpose of this cross was to combine the high quality of Comeback with the rust resistance of Cretan. Both varieties are of short to medium height (Plate 141), with fine straw of medium strength, and white, prominently bearded ears (Plate 155); this latter characteristic readily identifies them as they are virtually the only bearded varieties grown commercially in Australia. Both are very early in maturity, and though not highly resistant to leaf-rust and stem-rust, show a useful tolerance in the field to these diseases. The grain is somewhat opaque and fairly soft, providing a medium-strong flour of very useful baking quality. The combined acreage of these two sister varieties has placed them in either first, second or third position in the State since 1934. They have provided a useful standby for late main-season planting and have proved very reliable grain producers in the Maranoa, Burnett and Central Queensland districts. One of their main disadvantages is their liability to shatter if harvesting is delayed.

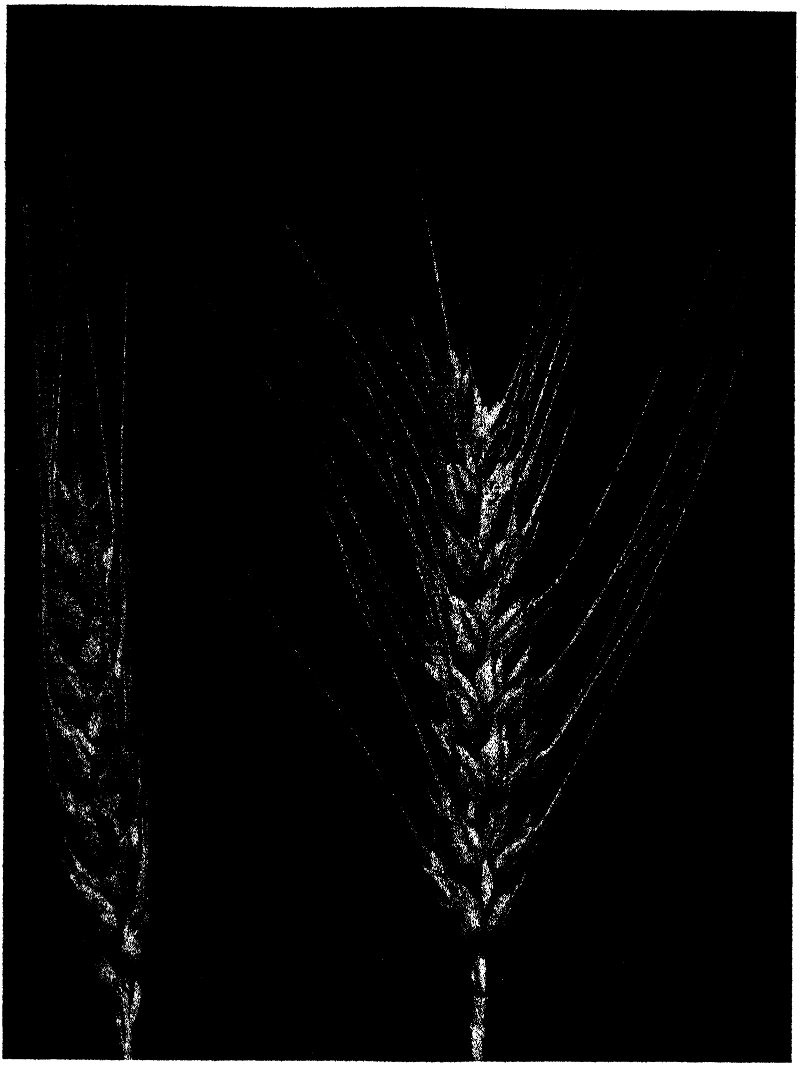


Plate 155.
Seafoam.

Warput.

This was bred from the cross Pusa-4 x Warren with the purpose of providing a good general purpose wheat suitable for green feed, hay or grain. It is a mid-late variety with fairly tall weak straw, and a long, curved, tapering ear (Plate 156) which is smooth chaffed and completely bald. Grain is fairly large, opaque to semi-translucent, and of satisfactory baking quality. While the variety is not highly resistant to rusts, it usually shows quite good field resistance, being superior to most of the older Queensland varieties in this respect. This variety was intended to displace Currawa as an early-sown dual purpose wheat. Currawa's main disadvantage was its poor flour quality, and in this

respect, as in rust resistance, Warput is definitely superior. Regularly occupying approximately 5 per cent. of the State's wheat acreage since 1938, Warput has given some excellent performances in terms of grain yields following one or more grazings during growth.

Plate 156.
Warput.

Plate 157.
Yalta.

Yalta.

This is another of the newer varieties bred for rust resistance at the Glen Innes Station of the New South Wales Department of Agriculture. It is a mid-season wheat with medium-tall, strong, coarse straw. Ears (Plate 157) are somewhat compact and of the squarehead type, with velvet chaff and one or two prominent tip-awns. The grain is medium-small, broad and plump, and a dark amber colour; the flour is of strong or premium quality. Yalta, while appearing a most attractive variety under reasonable growing conditions, has not been prominent in grain yield in Queensland. Moreover, the recent occurrence of a new form of stem-rust has reduced Yalta to the status of a highly susceptible variety. There is little therefore to recommend its use in preference to a number of the standard varieties for main-season planting.

SEED.

Seed wheat supplies are available through the Queensland State Wheat Board, Margaret Street, Toowoomba.

Having decided upon the variety or varieties to sow, the farmer can procure his seed from this source with the guarantee that it is true to variety, of the required standard of germination, free from disease, and graded. As with other crops, the use of sound and reliable seed free from contamination with weed seeds cannot be too strongly recommended.

A grower should never lightly discard a variety which has served him well over a period of years. Varieties which have been recommended to him by other farmers, or about which he has read glowing accounts, should not be widely adopted until they have been thoroughly tested under local conditions. New varieties released by the Department of Agriculture and Stock will have been subjected to field testing before release, and will be described from time to time in the *Queensland Agricultural Journal.*

A grower using his own seed should be sure that it comes up to standard and that it is free from disease and foreign seed. Varietal purity is another important matter, and in this connection the grower is reminded that the main sources of contamination are the complicated machines used for harvesting, grading and sowing. Of these machines, the harvester in particular is almost impossible to clean thoroughly without being taken completely apart. In actual field practice the best procedure to adopt when changing from one variety to another is to clean out the more accessible parts of the harvester before commencing on the new variety and then to reserve the required seed from the last harvested material of the second variety.

Seed Treatment.

Treatment of the seed with a fungicide for the control of bunt or ball smut is strongly advised. The presence of bunt in a field of wheat immediately rules it out for bread flour production, and the cost of the treatment at the rate of a few pence per bushel represents a very small premium to pay for insurance against the condemnation of a crop.

Dry powder treatment, or dry pickling, as it is often called, has for many years been universally applied for this purpose. The chemical used is copper carbonate, copper oxychloride, or one of the organic mercurial compounds, and the rate of application is 2 oz. per bushel of seed. The powder to be effective must come into intimate contact with all seeds in the mass to be treated. It may be applied by thorough mixing with the grain in a home-made pickler of the type illustrated in Plate 158 or in specially made machines which are available at reasonable price. In addition, picklers are frequently attached to the larger seed graders, and travelling outfits of this type will grade and treat the seed in the one operation on farms in the major wheat growing districts.

As the treatment with copper carbonate does not impair the vitality of the seed, even when stored for 12 months, it should be done as soon after harvesting as is practicable. This is particularly desirable if the grain is weathered or is of softer varieties such as Three Seas, for such grain is susceptible to weevil infestation. Prolonged keeping of seed treated with mercury dusts, however, should be avoided, as some reduction in germination may occur if storage extends over several months. Though the dusts will not destroy weevils actually in the grain, they will afford it some protection if not already infested.

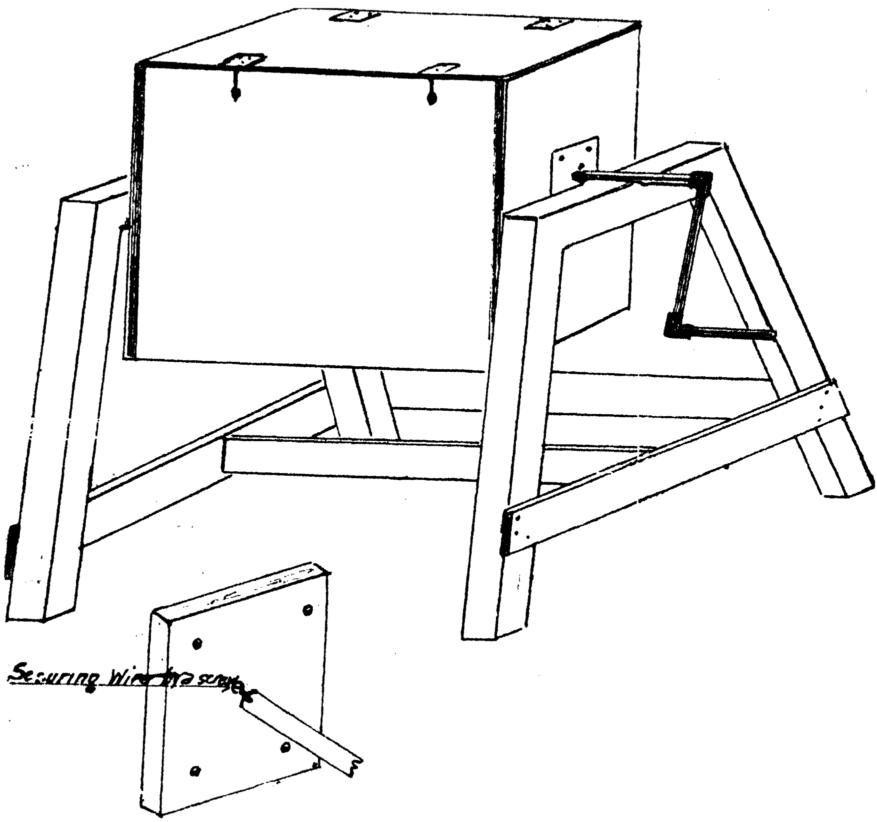


Plate 158.
Diagram of a Seed Pickler Made from a Petrol Case.

All dusts are harmful if inhaled in quantity; therefore, the precaution of covering the mouth and nostrils should be taken when pickling seed. A damp cloth or handkerchief may be used, though a cheap dust-mask or respirator is more effective and can be worn without discomfort. Surplus dusted grain should not be fed to stock or fowls, because of the poisonous properties of the pickling dust; the mercurial dusts are, of course, particularly poisonous.

Seed Storage.

Wheat seed is generally stored in bags either in a closed barn or outside on a raised platform, but wherever it is stored, the utmost care should be taken to make it secure from the attacks of rats, mice and other vermin, and to see that it is not directly exposed to the weather; otherwise, when required, it may be found to be worthless. In the event of weevils making their appearance, which is quite probable if the harvest is a wet one, it will be necessary to fumigate the seed with carbon bisulphide. For further details relating to insect control in stored grain, reference should be made to Departmental Pamphlet No. 114, entitled "Stored Products Pests."

SOWING.

Wheat in Queensland is almost universally drilled in at 7-inch row spacing by means of the standard grain drills of varying size. Broadcasting is seldom seen anywhere in the State, its limited use being restricted to small farms and usually for providing a small patch of green feed. Even in districts as far from the centre of the wheat belt as the Upper Burnett and the Dawson and Callide Valleys, grain drills (Plate 159) are standard farm equipment, their versatility enabling them to be used for sorghums, linseed, cowpeas and a variety of other crops in addition to wheat and oats. Drilling enables the seed to be placed in contact with moist soil at the desired depth, with ample covering to protect it from loss of moisture and from attack by birds and animals. Where the soil is in favourable condition for sowing, drilling will ensure an excellent germination and result in a very considerable saving in seed as compared with broadcasting.

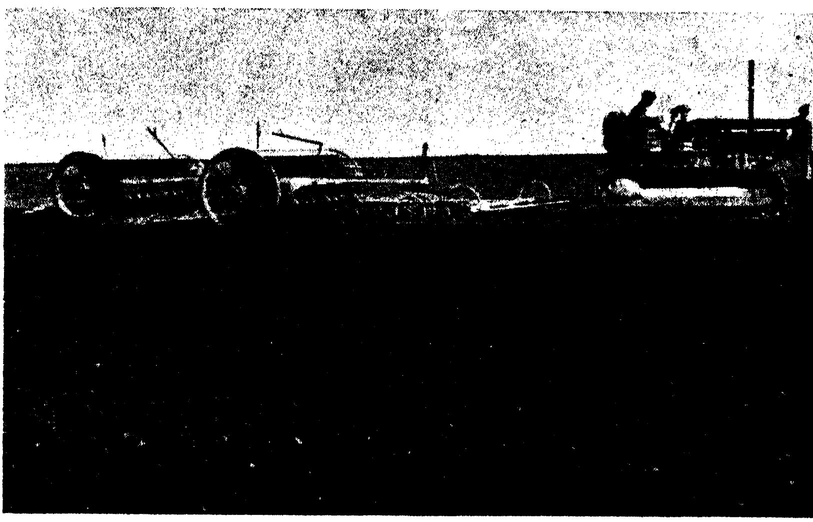


Plate 159.
Planting Wheat on a Large Grain Farm.—A heavy tractor and two combine drills in echelon are being used.

Two types of drill are at present in general use, the disc drill and the "combine" or cultivator-drill. The disc drill is the older type and was once in general use, but it has now been largely superseded by the combine. The latter type is a dual-purpose machine which enables the farmer in one operation to give the land its last working and to sow the seed, with the soil in the best possible condition to ensure germination. The combine drill has been a great boon to wheatgrowers, especially on soils which are inclined to run together after rain. On weedy soils, the use of this implement obviates the necessity for two separate operations of final cultivation and sowing. Such final cultivation would be vitally necessary to destroy newly germinated weeds after rain and to restore the surface mulch. If planting then had to be carried out as a separate operation, the area capable of being handled by each individual would be considerably reduced, and much of the seed would be placed less

favourably with respect to moisture than where the two operations are combined in one. Once a good stand of young wheat plants is well established they can normally compete successfully with weeds germinating on any subsequent rains.

With the removal of the grain tubes and attachments, the combine can be used continually as a spring-tooth or rigid-tine cultivator for the summer working of fallows. Both disc and cultivator drills are normally fitted with a fertilizer attachment capable of distributing any kind of commercial fertilizer.

Dry planting, though not advocated as a general practice, is sometimes advisable; this is particularly so where a large acreage has been prepared for sowing and the main sowing period has passed without planting rains. If portion of such an area is planted dry, it has a good chance of shooting away quickly with the first rain, and no delay will be occasioned if such rain should prove to set in for some days or even weeks. One of the main risks with dry-planted wheat is that, if the first rains experienced are only light showers, they may wet the seed sufficiently to cause it to malt and eventually rot, without providing enough moisture for full germination and safe establishment of the young crop. Another danger is that, if heavy rain follows dry-planting, the soil surface may cake so hard as to prevent the emergence of the young seedlings. For this reason, if there is any choice available, the areas chosen for dry-planting should be those with the lighter textured soils or the better self-mulching soils. Finally, when this practice is used, care should be taken that the seed is not buried too deeply, and particularly that it does not come in contact with soil which is damp enough to cause malting or premature shooting.

A word of warning is offered at this juncture. Grain left in drills overnight or during periods of drizzle is liable to consolidate, particularly if it has been treated with dust for disease control. When the machine is started up again after such an occurrence, so much strain is thrown upon the gears that a serious breakdown may result. Such a contingency can best be avoided by always giving the grain shaft a turn or two backwards and forwards before starting the machine again after a spell.

Rates of Sowing.

The most satisfactory planting rate varies somewhat from one district to another and from one variety to another. The overall variation in the seeding rate, however, is not great and the rate would generally lie between two-thirds of a bushel and one bushel per acre. For April-May plantings on the Darling Downs, 40-50 lb. of seed per acre will give an ample stand; for later plantings, in which stooling is likely to be less pronounced, it is customary to increase the seeding rate to 50-60 lb. per acre. In the drier district of the Maranoa, lighter stands are often more successful, and these rates can profitably be reduced to 30-35 lb. for early planting and 40-45 lb. for later planting. Of the minor wheat-growing districts, the areas with better rainfall should follow the recommendations for the Darling Downs, and the drier, hotter districts should follow those for the Maranoa.

Weathered grain and dry-pickled grain will not run as freely through the drill as a bright sample of untreated seed. It is advisable therefore, before commencing sowing operations, to check the calibration of the drill by making trial sowings with a few pounds of each variety

to be used. A calculation based on a
area covered by the time the grain l
the actual sowing rate for the partic
best carried out well ahead of actu
run out on to a piece of spare grou
for some time or has been subjected
its germination should be checke
germination percentage falls below
should be increased to compensate f

planted, whiptail symptoms may
later. The first symptom is then
tissue between the veins becomes
n a somewhat marbled appearance.
d and the chlorosis remains until
er leaves usually retain the normal
dges breaks down. This edge-burn
of the severe malformation recog-

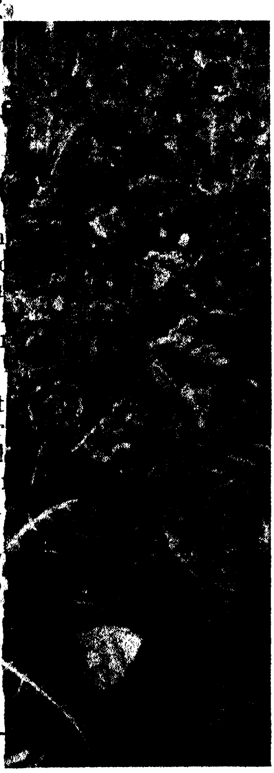
HARROWING

The harrowing of the growing
out with safety as soon as the youn
and have become firmly established.

Harrowing certainly drags out
but when the stand is not already
destroys weed seedlings, induces dee
tillering, which advantages will unde
up for any damage done. Many farm
harrowing the young wheat crops an
for soils which are inclined to bake
conservation be adopted by farmers
soil erosion, then, in such cases, har
attempted.

Where harrowing can be done, t
drilling in order to secure the best r
to a minimum. Harrowing across t
practicable for fields which have bee
of "round and round" drilling. In
harrow across the direction of the
should always be made of the effect
more damage than good is being do
harrow teeth free of soil.

[TO BE CON



60.
Variety) Affected by Whiptail.

PENICILLIN EMULSION

Veterinary officers of the Department
retailers and dairy farmers the need to h
temperature.

These products have been used extensi
of the common form of contagious mastit
years. However, it must be realised that th
effect if stored carelessly.

All manufacturers mark clearly on the
is marketed that it must always be kept in
at which the product should be stored; o
unnecessary if it is kept in a cool place.

The Department considers that during
to store penicillin products without refrig
the storage place, but it suggests that d
necessary to hold penicillin emulsions in a
should not be higher than 60 degrees.

m bear well, but the actual loss
n the time at which the disorder
of the symptoms. If the disease
arvested; if it appears late, some
be inferior in quality, as whiptail
tion to the developing curd.

eptibility.

the incidence of whiptail in the
determined by the molybdenum

status of the soil, is also influenced by the variety grown. The influence of the variety on the severity of whiptail symptoms in the field would depend mainly on its molybdenum requirements during the growing period.

Recent trials at the Redlands Experiment Station showed marked differences in the varietal reaction to a molybdenum deficiency on the red loams typical of this district. Whiptail occurred in two varietal trials at the Station during 1949. The first of these was designed to compare varieties which might be suitable for the early crop planted in the field during March. Of the seven varieties grown, three—White Queen, Snowball X and Snowball Y—completed their development normally. Early November showed mild symptoms of the disorder, but the other three varieties—Snowball A, January 68 and Early March—were all severely affected. Early March was a total loss, no flowers being harvested. In another trial which was field planted in May, all of the eight varieties grown showed whiptail symptoms. However, the two least affected were Model White and Rumsey's Snow. No heads were harvested from Early March.

So many factors are obviously involved in varietal behaviour in whiptail susceptible soils that trials over a period of years would be needed to make accurate comparisons. The foregoing differences are therefore, of general interest rather than a guide to the use of varieties by farmers in the metropolitan and near-metropolitan district.

Soils in Relation to Whiptail.

Trace elements such as molybdenum and boron are needed in only very small quantities by cultivated plants. A recognition of their importance in horticultural practice is comparatively recent, but there are indications that these deficiencies are becoming more acute in the intensively farmed market garden areas of southern Queensland. This could perhaps be expected, for two or three crops may be grown annually on the same soil and each removes its quota of the elements concerned. As supplies are limited in the first place, the reserves in the soil must sooner or later become depleted. Many intensively farmed soils near Brisbane are apparently reaching this stage.

Whiptail has been known for many years and reasonable control of the disorder can frequently be obtained by liberal applications of either dolomite or lime. Indeed, it has often been assumed that whiptail is characteristic of highly acid soils. Much of the land planted to cauliflowers in southern Queensland is naturally acid and liming would, therefore, bring pH value closer to 6·5, which is generally considered the most suitable for the plant. Liming apparently makes more of molybdenum reserves in the soil available to the plant. However, if these reserves are very low, liming does not always correct the disorder.

Control.

In areas where whiptail is known to occur, farmers should regard the disorder as a threat to cauliflower crops each year, and take the necessary precautions to prevent or control it. If liming is practised, but does not give complete control of whiptail, or if the condition of the soil does not warrant an application of lime or dolomite, then the

use of ammonium molybdate is recommended. The following control measures are based on experimental work carried out in other States, and confirmed in practice at the Redlands Experiment Station:—

(1) Seed-beds should be treated with ammonium molybdate at the rate of one-tenth of an ounce per square yard, applied one to two weeks before transplanting. It is convenient to dissolve one ounce of this substance in 10 gallons of water, applying the solution at the rate of one gallon per square yard of seed-bed. Contact between the solution and the plant leaves has no harmful effect, although the leaves may become temporarily tinged with a bluish colour.

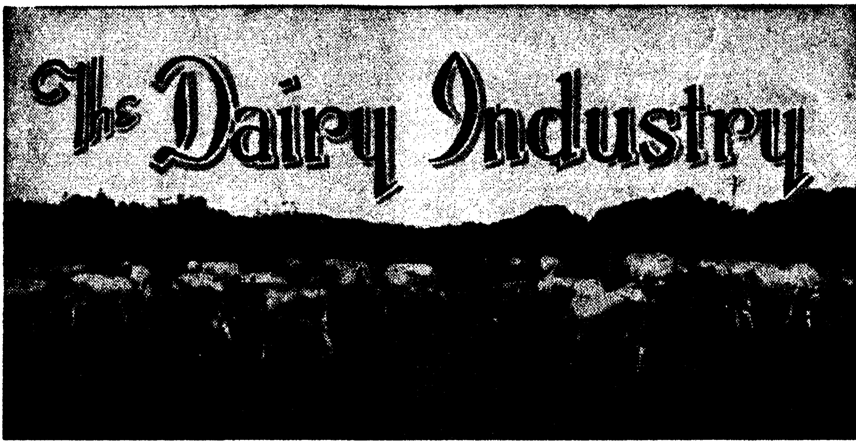
(2) If, after transplanting, plants from a treated or untreated seed-bed begin to show symptoms of whiptail, then ammonium molybdate should be applied at the rate of one pound per acre. One pound can be dissolved in 40 gallons of water, and the solution applied as a spray, or watered on to the plants with a watering can.

(3) If symptoms appear in the cauliflower seed-bed, ammonium molybdate should be applied promptly at the rate of one-tenth of an ounce per square yard. This application should be repeated one week before transplanting.

Ammonium molybdate is usually sold in a lumpy condition. It will dissolve readily in hot water, but should be ground to a fine powder before dissolving in cold water.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 25th MAY, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas
Jersey	W. E. O. Meier, "Kingsford" Stud, Rosevale, via Rosewood
A.I.S.	F. B. Sullivan, "Fermagh," Pittsworth.
Ayrshire ..	L. Holmes, "Bencecula," Yarranlea.
A.I.S.	D. Sullivan, Rossvale, via Pittsworth.
A.I.S.	W. Henschell, Yarranlea.
A.I.S.	Con O'Sullivan, "Navillus Stud," Greenmount.
Jersey	J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount.
Jersey	J. F. Lau, "Rosallen Jersey Stud," Goombungee.
A.I.S.	H. V. Littleton, "Wongalee" Stud, Hillview, Crow's Nest.



The Cooling and Holding of Milk and Cream on the Farm

F. G. FEW, Dairy Technologist, Division of Dairying.

INTRODUCTION.

IT is generally recognised that three major factors enter into the production of a good quality milk or cream on the farm. Briefly, these are a healthy herd, clean production methods and the prompt and efficient cooling of the product. All are problems in themselves and require particular consideration. This article is confined to the cooling problem and only so far as production on the farm is concerned.

Why Prompt Cooling is Necessary.

Milk from the udder of a healthy cow is practically free from bacteria likely to cause a rapid decline in quality. Despite all precautions, however, a degree of contamination from external sources is inevitable by the time the milk reaches the cans. If the milk has been properly cooled during this period, the rate of reproduction of the bacteria present is considerably checked, and with a limited population, little or no harm is likely to result.

Freshly drawn milk also contains inhibiting substances which restrain bacterial growth for a certain time. This period of protection is extended by prompt cooling, but if cooling is delayed, the effect soon becomes lost. A technique of prompt and efficient milk and cream cooling on the farm is thus invaluable, both to restrain the activity of any bacteria that may be introduced and to prolong the natural protective power of the product itself.

Degree of Cooling Necessary.

The temperature to which milk and cream should be cooled on the farm depends, to some extent at least, on the form of consumption intended for the product and on the holding time before despatch to the depot or factory. Milk, and especially that produced for the

whole-milk trade, should, if possible, be promptly cooled to a temperature around 40 deg. F., this practice being essential for the night's milk marketed the following morning. Milk is one of the most perishable of foods and, in all cases, requires prompt cooling if quality is to be maintained.

For cream used for butter manufacture by Australian manufacturing methods a temperature around 70 deg. F. allows of a desirable degree of ripening in a cleanly produced product. This temperature would therefore suffice if the cream was despatched to the factory within a short time. Under Queensland conditions, however, the holding time on a farm supplying cream is often considerable and to offset this fact a lower temperature should be the objective. Cream hygienically produced and promptly cooled to and maintained at 50 deg. F. will keep for relatively long periods. As deliveries to Queensland factories are usually not more frequent than three or four times per week, cooling to 50 deg. F. or less is thus the objective to be achieved wherever possible.

Holding Temperatures for Milk and Cream.

It appears axiomatic that it is of little use cooling milk or cream to avoid rapid deterioration unless the product can be kept cooled. A means of storage is thus necessary in all cases where milk or cream is to be kept for any time on the farm. The temperature of the cool storage accommodation provided should at least equal that to which the product is cooled, a temperature not exceeding 40 deg. F. being required for milk and approximately 50 deg. F. in the case of cream.

Requirements of Cooling Systems.

Milk and cream when freshly produced on the farm will be found to have a temperature around 90 deg. F. Any cooling system in use will thus be required to reduce this temperature quickly and the ideal system will enable a temperature drop of about 40 deg. F. to take place.

Heat will only pass from one object to another if the latter is at a lower temperature. The first requirement for milk or cream cooling is thus a suitable medium at a temperature below that to which the product is to be cooled. In practice, air and water are the only natural media available.

When heat can be transferred, the rate of cooling is proportional to each of two factors—the surface area of contact and the temperature difference. Either factor can alter the rate of cooling to the same extent—for example, by doubling one factor the amount of heat removed in the same time is doubled.

Consider a can of milk or cream freshly produced on the farm and allowed to stand in air or water. The temperature will be around 90 deg. F., which is likely to be about 20 deg. F. above both the atmospheric temperature and that of water normally available on the farm. Due to the temperature difference, the milk or cream will start to cool, and eventually the air or water temperature will be reached. Experience shows, however, that this technique is not satisfactory, as the cooling rate is so slow as to be useless for safeguarding quality. It is true that the rate of cooling is somewhat faster when water is used instead of air, but even so the product is still at a high

temperature for too long a period. Bacteria which multiply rapidly between 70 deg. F. and 90 deg. F. are likely to spoil the milk or cream in the time required to effect cooling by standing the cans in either air or water at atmospheric temperature.

Assuming that the cooling must still be effected in the can, it is obvious that the surface area through which the heat is withdrawn remains the same. Thus the only way of accelerating cooling is to increase the temperature difference. If a cooling medium is available at 50 deg. F. instead of 70 deg. F., it follows that with a 90 deg. F. milk or cream the initial rate of cooling will be doubled, since (90 — 50) = 2 x (90 — 70). Practical results have again shown that satisfactory results can be obtained by bulk cooling in cans with a chilled water or brine at considerably below 50 deg. F. The farm refrigerator system for milk cooling utilises this method with the addition of certain refinements to still further increase the cooling rate. The bulk cooling of milk or cream in cans by standing in air cooled to even 50 deg. F. or below is still unsatisfactory due to the much lower rate of heat transfer to cold air as compared with chilled water or brine.

The requirements for efficient cooling can now be considered in a different light by fundamentally altering the technique employed. Reviewing the two factors affecting the rate of cooling, it will be seen that the surface area provided has not as yet received attention. It so happens that it is a matter of little difficulty to enormously increase the contact cooling area, and the most efficient cooling systems largely exploit this fact.

The milk or cream can be made to expose a large area to the cooling medium by merely allowing it to gravitate in a thin stream over a suitable device. Quite a number of such have been devised, the most satisfactory for farm use being the tubular surface cooler. The cooling medium—water, brine, or refrigerant—is contained within the pipes of the cooler and the milk or cream gravitates slowly from the top to the bottom in a continuous stream. At any given instant a small quantity of milk or cream exposes a large surface area to the cooling medium. This results in rapid cooling, and, with proper design, a temperature approximately the same as the medium is reached by the time the milk or cream leaves the cooler. The essential requirements are, of course, a suitable tubular cooler and a supply of cool water, brine or refrigerant. Where water is used it is important to ensure that its temperature does not rise after prolonged use, and a means of recooling is generally advisable. A supply of brine or refrigerant obviously requires a refrigerator unit designed according to the cooling requirements to be met.

Types of Cooling and Holding Systems.

It is convenient to consider farm cooling under separate headings, depending on whether milk or cream is the product in question. This is not due to any fundamental difference in the principles involved, but merely because of practical requirements. The volume of milk produced is roughly ten times that of its cream content, and ten times as much cooling is involved. Cream is also usually held for much longer periods and storage is of great importance for this product. Milk is never held on the farms for periods longer than overnight, and as a result immediate initial cooling is generally more significant in this case.

The most satisfactory methods of cooling and holding milk and cream on the farm are as follow:—

Milk.

(1) Farm refrigerator units in conjunction with initial water cooling using the tower re-circulating system.

(2) Water-cooling alone using recirculated water from a tower system with overnight storage in a pit extension.

Cream.

(1) Farm refrigerator units.

(2) Water-cooling of the cream followed by storage in a charcoal cooler.

The methods listed above employ one or more of the following—farm refrigerator units, water-cooling tower, and charcoal cooler. Details regarding each will be considered separately and in the order given.

FARM REFRIGERATOR UNITS.

For some years past two Dairy Associations in Queensland have sponsored the use of refrigerator units on the farms of their suppliers. The good results obtained were responsible to at least some degree for the move by the Queensland Co-operative Dairy Companies' Association for a universal scheme for the State. The outcome of discussions held

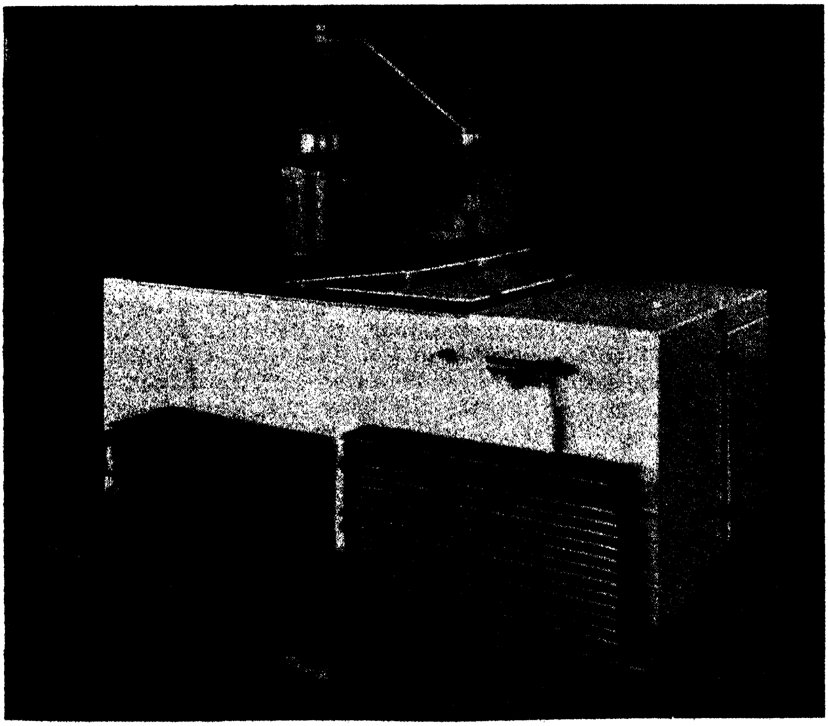


Plate 161.

Immersion-type Farm Refrigeration Unit for Milk.

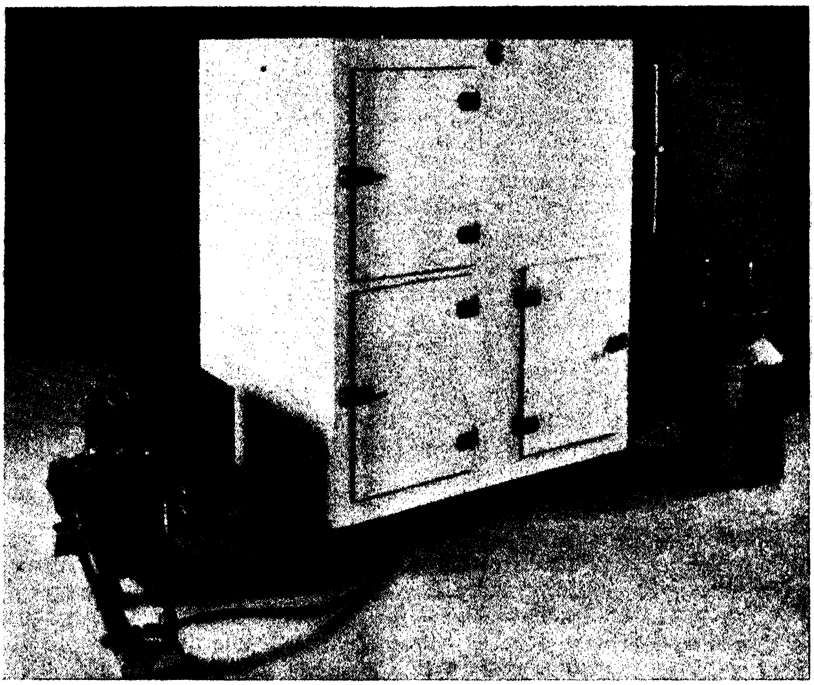


Plate 162.

Air-cooled Type Farm Refrigeration Unit for Cream.

was the present scheme for provision of farm refrigerator units by the Queensland Butter Marketing Board, whereby any farmer in the State can purchase one to suit his requirements. Several different types (two are shown in Plates 161 and 162) are available to meet the various needs on the farm, with or without certain refinements as desired by the farmer himself. Three different sized units are available for milk supplying farms, capacities being 40, 60 and 80 gallons—using 10 gallon cans—per day, respectively. In each size two different models can be supplied, depending on the necessity or otherwise for the shock cooling of milk on the farm. Again, two types of each model are available, one with and one without storage facilities for household foods. Four models in each size are thus actually assembled, though as far as the method of cooling utilised is concerned, there are simply two models in each size. The degree of cooling on which the capacity is based is from 72 deg. F. to 40 deg. F. for the two smaller models and from 90 deg. F. to 40 deg. F. (equal to 110 gallons from 72 deg. F. to 40 deg. F.) for the largest size, with the machine operating 6 hours per day in each case.

Methods of Cooling.

The cooling is effected in one or two ways, both of which, as indicated earlier, have been shown to be satisfactory. These methods are—

(1) Cooling in cans with chilled water at an initial temperature around 34 deg. F. The milk is first cooled to around 70 deg. F. by an independent method to be considered at a

later stage. The refrigerator unit utilising this method is decribed as an "immersion" unit, as the cans of milk are immersed to shoulder height in the cooling medium contained within a tank in the refrigerator cabinet. Accelerated milk cooling is achieved by the use of sprays which effect agitation and materially improve the heat transfer rate.

(2) Shock-cooling using a double cooler, the top section of which employs cooling by an outside water supply, with chilled water cooling in the bottom cooler section. A small pump circulates the chilled water from the tank within the refrigerator cabinet. This system ensures that the milk is cooled to approximately 40 deg. F. within a short time of its leaving the milking machine.

Farm milk refrigerators of the immersion type are used where the time interval between milking and despatch to the factory or depot is sufficient for the milk to fall in temperature to 40 deg. F. Generally speaking, this is only true where the night's milk is to be held over until the following morning, though in some cases the waiting time in the morning may be sufficient.

Refrigerators of the immersion type are thus designed to suit any milk supplier desiring to market the night's milk the following morning. The morning's milk is, of course, also most likely to be marketed in addition, but cooling by the refrigerator unit should not be relied upon in this case.

The shock-cooling units are employed where it is imperative to cool the milk to 40 deg. F. in the short time between milking and despatch from the farm. Their use is particularly valuable in the case of milk from the morning's milking being supplied for consumption in the whole milk trade. The immersion tank within these units is used for the cooling and storage of the night's milk as previously explained.

Units Available.

All farm milk refrigerators consist of a cabinet containing the immersion tank and with or without the special food storage compartment. The condensing units are situated external to but adjacent to the cabinet and are normally driven indirectly from the engine operating the milking machine. The surface, tubular shock-cooler is conveniently placed to allow the milk to gravitate directly to the receiving can after leaving the cooler.

Farm refrigerator units suitable for the cooling and holding of cream are available in three sizes, holding 4, 6 or 8 cans (8 gallon size), respectively. In all models the cream is shock-cooled, using a small surface cooler and an anti-freezing (sweet-brine) solution from a copper tank within the cabinet unit. The largest unit can be fitted with a larger compressor unit if so desired, thus cutting down the necessary running time each day. For the hotter districts of the State the larger compressor unit is also a definite advantage. After the cream is shock-cooled to 50 deg. F., the cans are merely stored in an air-cooled compartment until despatched to the factory. The storage temperature is between 40 deg. F. and 45 deg. F., to which the cream would slowly cool during storage. Household compartments are standard on all cream-cooling farm refrigerators, but this space can be used alternatively for additional can storage if so desired.

All units for milk or cream can be fitted as automatic, thermostatically controlled units provided electric power from an outside reticulating system is available on the farm. Additional requirements are an electric motor and a thermostat, and the extra expense is fully justified if power is available. With such fittings the machine can operate at will to suit the daily loading instead of depending on the relatively fixed hours during which the farm engine is normally in use.

Prevention of Corrosion.

Little if any attention should be normally required by farm refrigerators and maintenance is similar to that required by domestic or other refrigeration units. Generally speaking, the services of a qualified refrigeration serviceman are required, as the work is outside that possible on the average farm. Immersion units should, however, be given attention as far as the chilled water in the immersion tank is concerned. Without attention some degree of corrosion of the mild steel strips used for strengthening the copper tank is likely to occur. The milk cans may also suffer unless the external tinning is in very good condition. The following recommendations are given with respect to the avoidance of undue corrosion in such immersion tanks:—

(1) Only the best quality water available should be used, and if tank water cannot be obtained the softest supply on hand is to be preferred. Rain water should be used if at all possible.

(2) The chilled water in the refrigerator unit can be rendered relatively non-corrosive by maintaining it slightly alkaline in reaction. This is best accomplished by adding caustic soda, soda ash, or, if both are unobtainable, freshly slaked lime. Household washing soda is also effective, as it contains the same chemical as soda ash, but it is much weaker because of the large proportion of combined water normally present. Using the first mentioned chemicals, a tablespoonful of one or the other will quite likely prove sufficient, particularly if rain water is used in the chilling tank. A larger dosage may be required if washing soda is used, but care must be taken to avoid making the water too alkaline.

The correct degree of alkalinity can be easily checked by adding one drop of ordinary phenolphthalein solution—as used at butter factories for cream neutralisation—to a tablespoonful of the water in an ordinary white china cup. A faint but definite pink colouration indicates a degree of alkalinity consistent with a minimum corrosive effect both on the immersed cans and the mild steel strips on which they rest.

(3) With care in the external cleanliness of cans and avoidance of milk spillage, the charge of chilled water should last some time. A certain amount of topping up with fresh water is likely to be required but, unless excessive, only an occasional test on the degree of alkalinity (with correction if required) should be necessary.

(4) When it is evident that contamination of the water has taken place, the chilling tank should be emptied completely and thoroughly cleaned. When dry, the mild steel bars should be painted with an aluminium paint, and after drying the tank can be recharged and treated once again to ensure alkalinity of the water.

Costs.

The cost of farm refrigerator units varies with the model and from time to time with the actual cost of manufacture and assembly. At present prices vary from £209 to £330, with £15 extra for fully electric machines. Full particulars regarding latest prices and recommendation for specific farm needs can be obtained at any time by writing to the Manager, the Queensland Butter Marketing Board, P.O. Box 1020 N, G.P.O., Brisbane.

WATER COOLING TOWER.

When milk or cream is cooled by a liquid medium, either directly in the can or through the tubes of a surface cooler, the liquid temperature must rise, as the heat is merely transferred and not eliminated. Provision to cool the medium itself is thus imperative if the process is to be continuous, unless the supply of cool liquid is relatively inexhaustible. In farm refrigerator units, employing either chilled water or sweet brine, this necessary cooling is effected by the compressor, which is designed accordingly. The initial chilling, to approximately 70 deg. F. under summer conditions in the case of milk units, is accomplished by using water, and means for its continued cooling is thus generally an additional requirement. Even in cases where the water supply is unlimited, it is also advantageous to recirculate only a limited quantity if such can be cooled below the mean temperature of the main supply.

Many methods of cooling re-circulated water by natural means have been tried with varying degrees of success. The principle employed is that of self-cooling whereby a portion of the water evaporates and in so doing cools that left for recirculation. Some direct heat transfer to the air is also possible, but only if the water temperature is above that of the air itself. The amount of evaporation possible, however, depends on the percentage saturation of the air with water vapour; the lower this value the greater the degree of evaporation and thus the greater the degree of self-cooling possible. Any effective water-cooling system must thus make possible the greatest degree of cooling compatible with existing atmospheric conditions, and the efficiency of such systems is determined on this basis. As the lowest temperature to which water can be cooled by natural, evaporative means is the so-called wet-bulb temperature existing at the time, this figure is used to evaluate farm cooling efficiencies. Although this temperature varies considerably, both from day to day and throughout any particular day, it does not, even under Queensland summer conditions, exceed 70 deg. F. over quite a proportion of the dairying areas of this State. The natural cooling of water by self-evaporation to this temperature is thus quite practicable in these areas and can be used effectively for reducing milk or cream from its initial temperature of around 90 deg. F. During most months of the year the wet-bulb temperature is much lower than 70 deg. F., thus making a greater degree of initial milk or cream cooling quite within reach.

Of many different methods tried for cooling water to the lowest possible temperature, the most satisfactory is considered to be a water cooling tower system. This is not a new method and most farmers will be familiar with the technique which is exemplified by the cooling of recirculated vacreator water at butter factories and is often used for cooling engine jacket water at factories or local power houses.

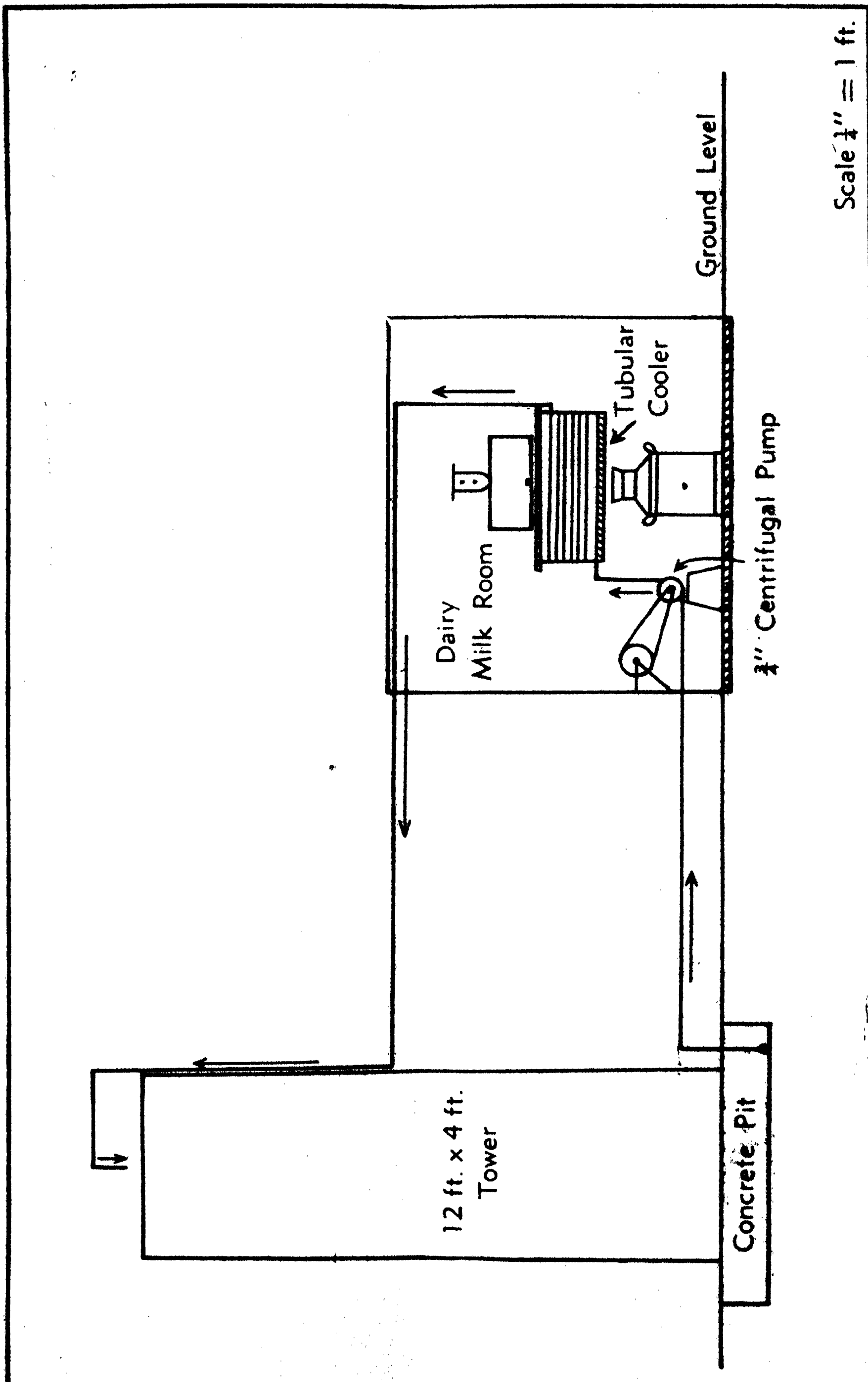


Plate 163.

Diagram of Circulation System of a Water-cooling Tower.

Some years ago experimental work was carried out to decide on a type and size of cooling tower suitable for farm requirements. Since that time observations have been made on many towers installed, and, in addition alternative methods suggested have been carefully tested. Results have shown that the most efficient cooling has always been associated with the water-cooling tower. In some cases large reserves of water have been used without provision for re-cooling, but the results obtained were not comparably satisfactory. The details of the water-cooling tower system recommended for farm use are as under.

Description of Water Cooling System.

Plate 163 shows the general arrangement of the tower-recirculated water cooling system. The water is drawn from the 1 ft. deep concrete pit below the tower by means of a ¾-in. centrifugal pump driven from the dairy house mainshaft as shown. The water is pumped through the tubular surface cooler and finally delivered for recooling at the top of the tower. The tubular water coolers which are familiar to most farmers are the only type suitable for milk or cream cooling using tower-cooled recirculated water. The tower is placed away from the dairy building to ensure the proper ventilation essential for water-cooling. It should be located on the side of the building exposed to the prevailing winds during the summer months, but need not be far away provided free air access on its four sides is assured. The amount of water needed for recirculation is not large and the pit shown on the tower drawings will hold ample water (approximately 200 gallons). A deep pit is not advisable. Tests have shown that water leaving the tower is generally cooler than a large volume of water in a deep pit, and hence, on mixing, the water leaving the cooler is higher in temperature than need be. Only sufficient water to properly cover the foot valve is required. The other advantages of a shallow pit are ease of cleaning, safety where children are present, and a greater rate of circulation due to the much smaller suction lift, unless (as is rarely the case) a deep pit is filled to the same water level. The cost of constructing a deep pit is also an item of importance, especially if it is made throughout of concrete, and results have shown that it is of no advantage from the viewpoint of efficient cooling.

Materials for Tower Construction.

All timber is of undressed hardwood; the concrete is made of 4:2:1 mixture. The water distribution tray as shown is preferably of plain galvanised iron with 3 in. sides and perforated over its whole base area, although it can be made of boards (6 in. by ½ in.) closely butted together and with ½ in. holes bored along the centre of each board. The timber required is as follows:—

Tower Uprights: Four 3 in. by 3 in., 15 ft. long.

Louvres: Start 2 ft. from ground level and spaced 5 in. apart vertically; 25 are required for each side, or 100 for the complete tower. They are of 6 in. by ½ in. hardwood and are 3 ft. 4¾ in. in length. Each louvre extends across the 3 in. face of the holding 3 in. by ⅝ in. batten strip, resulting in a vertical overlap of ⅝ in. and 1½ in. measured along the louvre. Eight lengths of battening each 10 ft. long are required to hold the louvres.

Tower Bracing: Of 3 in. by ⅝ in. battening. Eight pieces each 7 ft. long are required.

Baffles: Made of 6 in. by ½ in. hardwood. Five are required for each complete baffle, each board being 3 ft. 4 in. long. For the four sets of baffles, 20 such boards are thus required.

The baffle boards are nailed to cross supports, two of 3 in. by 1½ in. hardwood and 3 ft. 6 in. long being required for each complete baffle. Similarly these are flushed into the two 3 in. by 1½ in. supports, each 4 ft. long, bolted to the tower uprights.

Summary of Materials Required—

Timber—

3 in. by 3 in. hardwood—four lengths of 15 ft. each.

6 in. by ½ in. hardwood—100 lengths of 3 ft. 4¾ in. each; 20 lengths of 3 ft. 4 in. each.

3 in. by 1½ in. hardwood—8 lengths of 3 ft. 6 in. each; 8 lengths of 4 ft. each.

3 in. by ⅝ in. hardwood—8 lengths of 10 ft. each; 8 lengths of 7 ft. each.

Concrete: Materials for approximately 20 cubic feet, allowing for concreting in of tower uprights. This requires about two-thirds of a yard of sand-gravel mixture and four bags of cement.

Piping: ¾ in. galvanised of a length determined by position of tower relative to dairy building. Clips to hold piping tower also required.

Bolts and Nails: 16 bolts each ⅜ in. by 6 in. long. Nails—supply of 2 in.

Water Distributing Tray: Plain galvanised iron sheet 3 ft. 6 in. square with 3 in. sides soldered.

Circulating Pump: ¾ in. centrifugal pump, belt-driven from shaft in dairy.

Cooler: Standard tubular cooler for either milk or cream as the case may be.

Construction of Tower.

The four tower uprights are erected on the chosen site after first excavating the necessary pit below the ground level. The posts are concreted in the ground up to the level of the bottom concrete of the pit—that is, up to 1 ft. 3 in. from the ground level. The baffles and distributing tray are assembled and placed in position as shown in Plates 164-167. Sections of battening from the 10 ft. lengths are cut to fit between the supports (B) bolted to the uprights and the appropriate numbers of louvres are fixed to the battens by nailing through from the outside of the battens into the louvres themselves. The assembled sections are then nailed to the tower uprights, the nails passing through the battens in the reverse direction to those holding the louvres. The tower bracing is then finally secured, and the piping, &c., arranged as required. Construction of the concrete pit is carried out, and any light iron or steel reinforcements available can be advantageously added when laying down. Similarly, a concrete path drip 2 ft. wide all round the tower prevents mud, &c., from easily entering the pit during wet weather or following excessive drift loss from the tower due to high winds. The path should slope away from the tower across its width to prevent water entering the pit during wet weather.

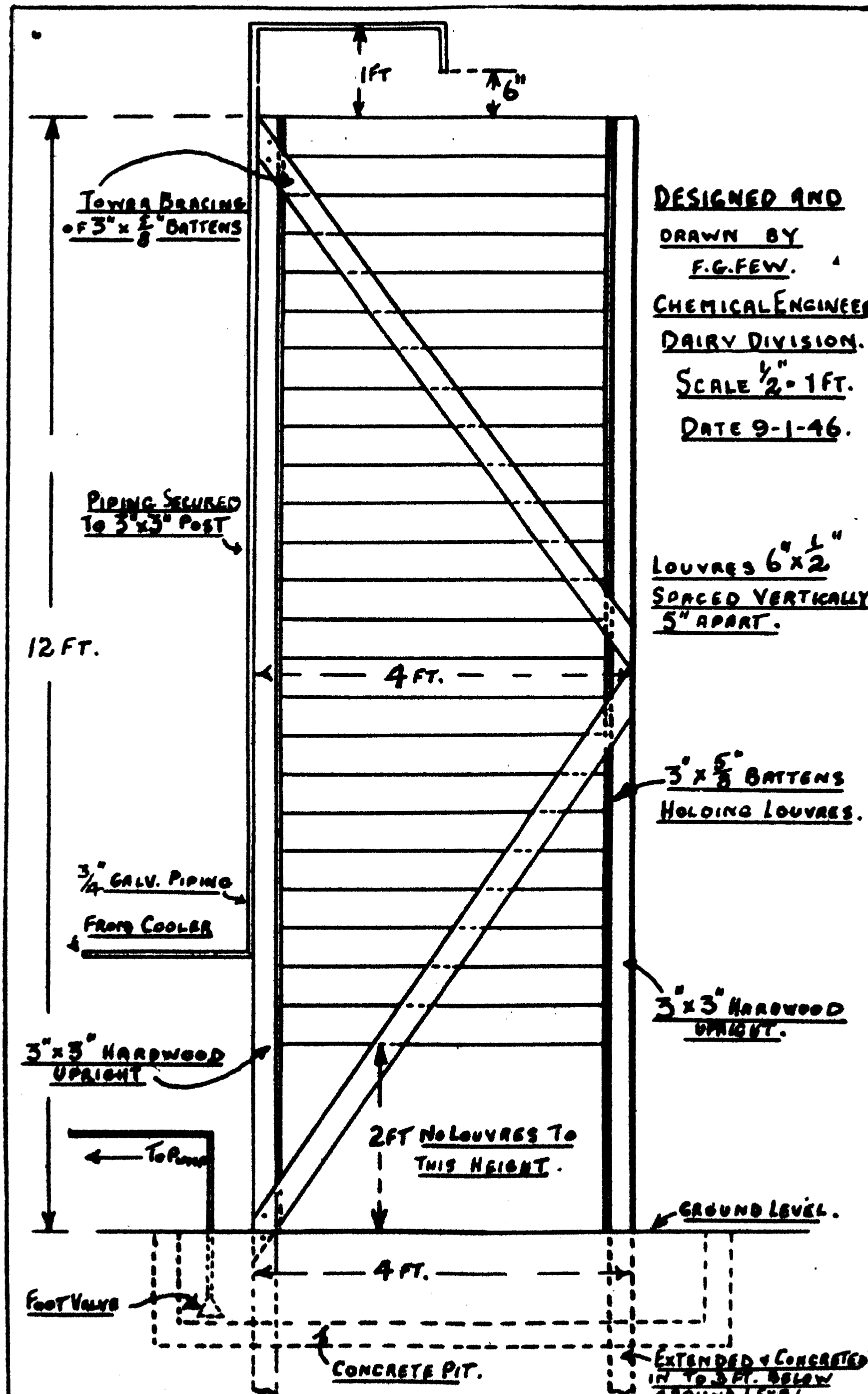


Plate 164.
Elevation of a 4-ft. Square Water-cooling Tower.

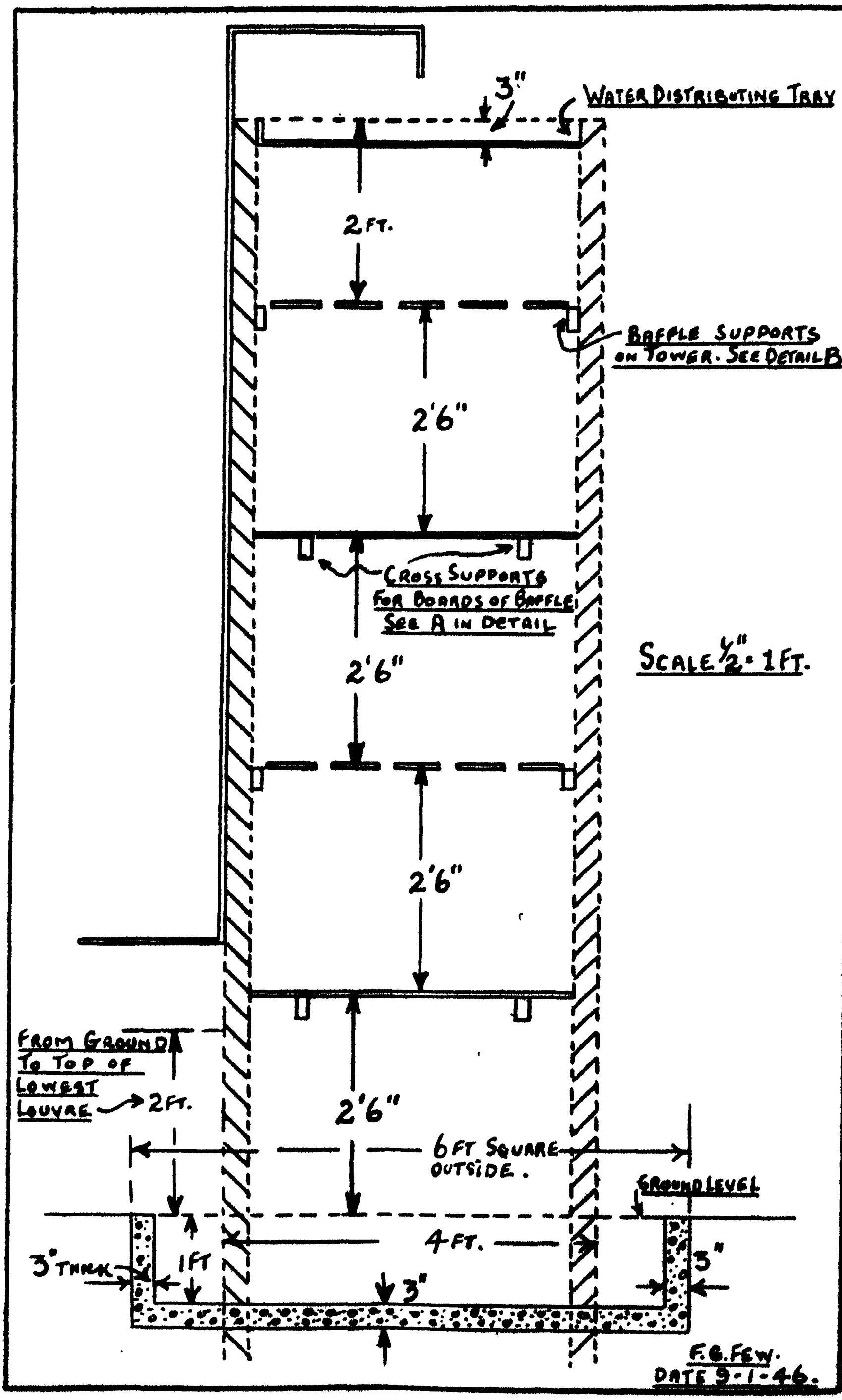


Plate 165.

Sectional Elevation Showing Number and Disposition of Baffles and Concrete Pit.

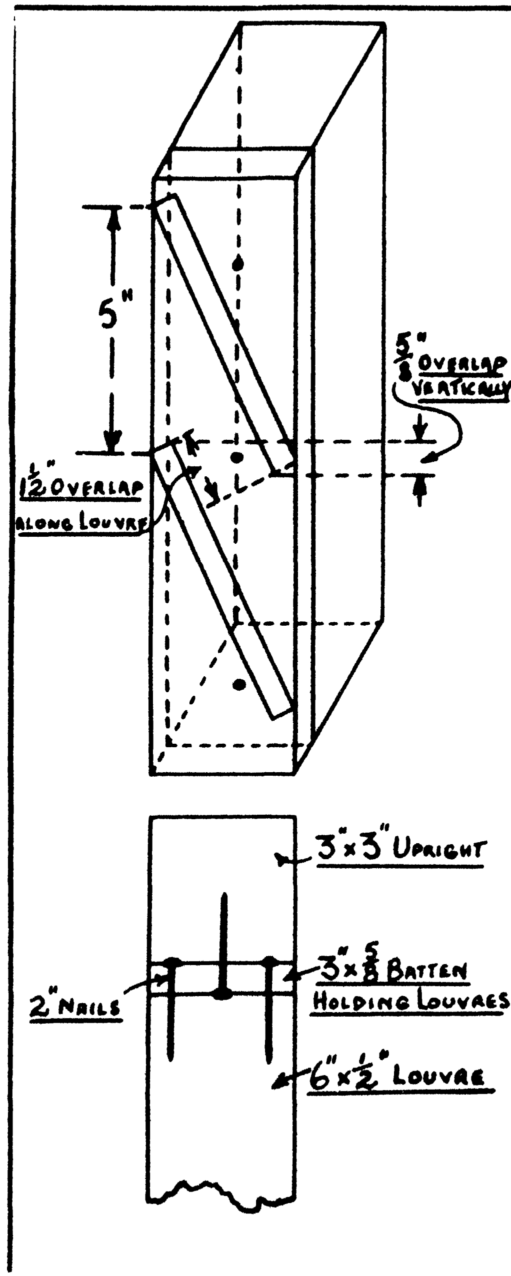


Plate 166.

Diagram Showing Method of Nailing Louvres to Batten Strips and Assembled Sections to Tower Uprights.

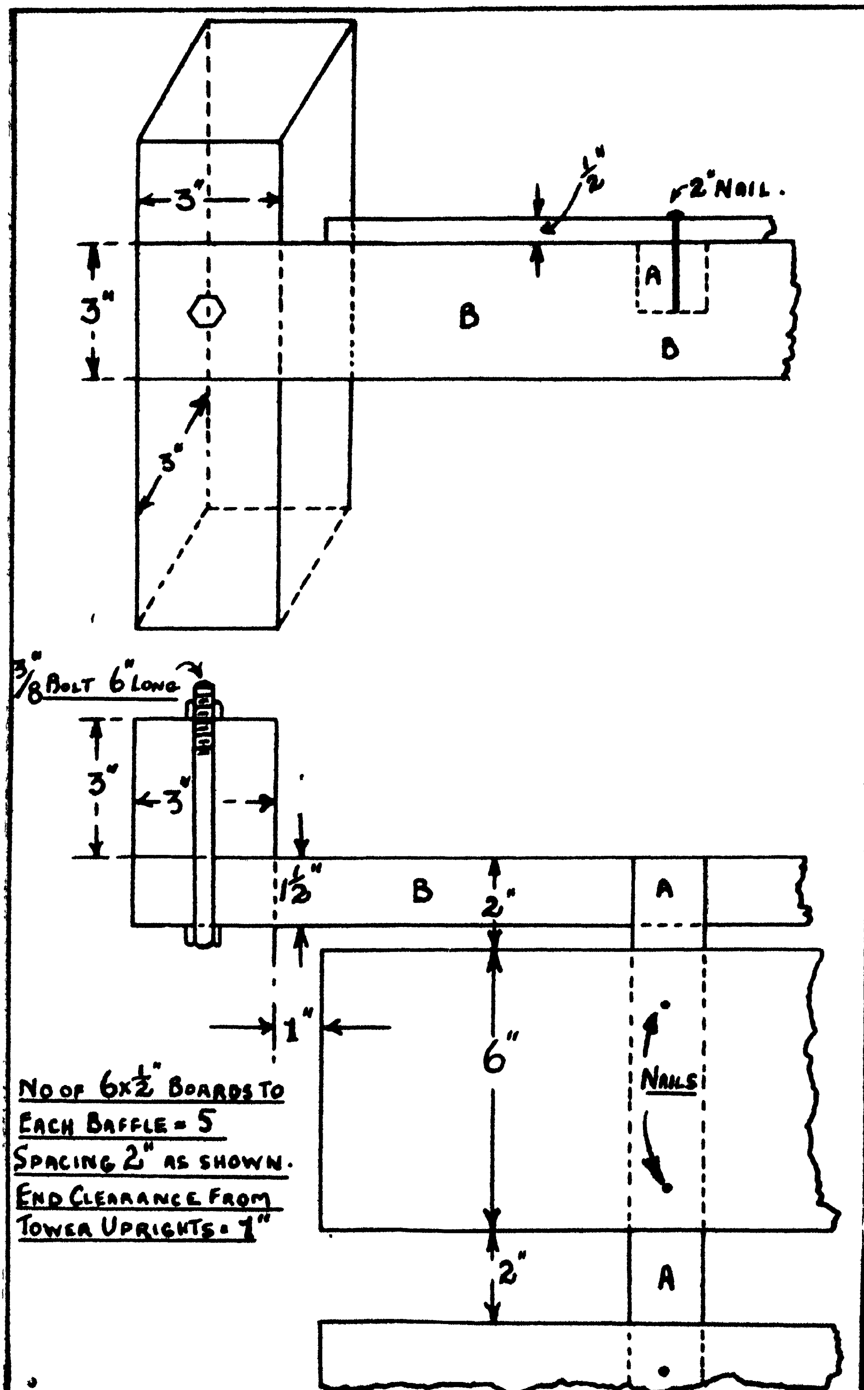


Plate 167.

Diagram Showing Baffle Boards Nailed to Cross Supports (bottom); and Support for Completed Baffles Bolted to Tower Uprights (top).

Variations in Design.

It is quite obvious that any person building a water-cooling tower may be prompted to depart from the standard design submitted. (See Plates 168 and 169.) There is no harm in this provided the fundamentals are preserved. The number of baffles and their disposition must be adhered to as they are inherent in the design of the unit. Of many modifications seen and suggested as the result of experience two are worthy of consideration in this article. The upright posts may be supported on horizontal cross members supported by the concrete sides of the water pit. This avoids any deterioration in the timber at or below the water line and also a leakage loss of water due to the concrete shrinking away from the posts after ageing. Unless rigidly constructed, however, the tower is likely to be less stable, and proper reinforcing of the concrete sides of the pit and secure holding down bolts for the cross timbers are essential. This variation is, however, not necessary if occasional attention is given to the uprights the preservation of which is not a matter of particular difficulty.

On some farms, unequipped with refrigerators, the problem of can storage is often one of difficulty. A type of cool storage cabinet especially designed for this need will be considered later and is the recommendation given if the farmer is not prepared to install a farm refrigerator unit. Storage for a relatively short time can, however, be provided by extending the pit of the water-cooling tower and increasing the depth in the extension to approximately 18 inches. The cans of milk or cream can be placed in this extension and will be kept at approximately the same temperature as that achieved during cooling while awaiting despatch from the farm. The size of the extension required can be determined by the farmer and will obviously be sufficient to suit the number of cans to be held. The required water level throughout should be sufficient to just fill the pit with the cans in place, and the equivalent depth without the cans should be indicated by a permanent mark to facilitate replenishing when necessary. A cover should be provided over the pit extension to keep off direct sun and any water spray from the cans during the storage period.

Plate 168.

Water-cooling Tower (at left), Showing Situation in Relation to Bails and Milk Stand.

Plate 169.

Close View of the Tower Shown in Plate 168.

Use of Water-cooling Tower.

The water-cooling tower is recommended for use in all cases where water is used solely for milk or cream cooling or if water is complementary to refrigeration in the case of milk. For the farm chilling of milk for the liquid whole milk trade, where farm refrigerators are recommended, initial cooling with tower-recirculated water is very desirable. The result is that approximately half the heat that must be eliminated from the milk can be removed without the expenditure of refrigeration. The capacity of the machine installed is thus, in effect, doubled; alternatively, the cost of refrigeration for the same milk handled is halved. If a farmer is not prepared to install a refrigerator unit the milk can be cooled to approximately 70 deg. F. even under summer conditions by the use of the tower system. While this is not a temperature sufficiently low to adequately safeguard initial milk quality, it is very much superior to no provision for cooling and results have been quite satisfactory in most cases. This is particularly true where the morning's milk is despatched from the farm without undue delay.

For cheese milk suppliers the tower cooling system has been shown to give very good results. Most farms producing milk for this purpose are either without cooling facilities of any kind or at most employ rather primitive and inefficient methods. The use of

refrigerators on farms supplying milk for cheese manufacture will, of course, prove satisfactory, at least as far as the cooling requirements are concerned. If their use is not contemplated, however, the tower system is recommended, with storage of the evening's milk in the pit extension previously described. Generally very good results can be expected from the evaporative cooling of water on the Darling Downs—the chief cheese-producing area in the State—due to low relative humidities usually experienced. No better system for the cooling of milk by natural means has been devised, and efficiencies achieved are quite high even when based on a somewhat difficult provisional standard. A consideration of the standards on which cooling is evaluated will be given at a later stage.

For farms producing cream the use of refrigerator units is recommended without exception. Although initial water cooling can be combined with refrigeration, it is not really justified with the relatively small cooling load to be accommodated. All farm refrigerator units are designed to allow for shock cooling of the cream throughout the whole range of temperature necessary, and with such provision water-cooling is not required.

Where farmers are not prepared to install refrigerators, the water tower system can be advantageously used to cool the cream as much as possible. Due to the high water/cream ratio possible, the latter can be cooled practically to the existing wet-bulb temperature. Storage overnight can be provided using a pit extension, but as some cream has also to be kept during the daytime in most cases, the charcoal cool cabinet is generally required for cream storage. The pit extension is thus more generally useful in the case of a cheese milk farm where the installation of a farm refrigerator unit is not contemplated.

Costs.

It is not possible to give exact costs because of the many variable and local factors involved. When the initial field investigation on a water cooling tower was made about five years ago, the complete installation cost was around £20 if the farmer erected the tower himself. The equipment included in this cost was a suitable tubular cooler (24 inch by 13 inch), ¾ inch centrifugal pump with wooden driving pulley, timber and cement.

Costs have risen considerably in the interim and an expenditure of at least £30 can be expected if none of the equipment required is already on hand. If labour has to be hired for any of the work the cost will, of course, be additional.

[TO BE CONTINUED.]

FREE SEED-TESTING SERVICE.

The Department of Agriculture and Stock is prepared to examine for purity and germination seeds purchased by farmers for their own sowing. Inquiries regarding this free service should be addressed to the Standards Officer, Department of Agriculture and Stock, Brisbane.

Crop Planting Tables—Northern and Central Districts.

Showing Times of Planting and Rates of Sowing for Field Crops.

BY OFFICERS OF THE AGRICULTURAL BRANCH.

QUEENSLAND is a large State covering a wide range of climatic conditions, and in a crop planting summary it is impossible to define accurately planting and harvesting times for each and every area. The tables which have been compiled for the various agricultural areas are intended to be a general guide with reference to the season generally experienced, and in determining sowing times attention has been paid to the seasonal conditions under which it is expected harvesting would be carried out.

Zones.

For the purposes of the tables, Queensland has been divided into three main zones as follows:—

Southern Districts.—Included in this zone is the area south of latitude 25° (approximately Bundaberg) to the southern border of Queensland.

Central Districts.—This zone lies between latitude 20° (approximately Bowen) and latitude 25°.

Northern Districts.—All districts north of latitude 20° are grouped in this zone.

The Coastal Districts within each zone refer, for the most part, to the land between the main coastal ranges and the seashore—approximately a 30-mile strip. In some areas, where the influence of coastal rainfall extends further inland, this strip may be wider. The Inland Districts are defined as beyond that limit to the outer edge of the 25-inch annual rainfall belt. Tableland Districts refer to elevated areas within about 100 miles of the coast.

Generally speaking the bulk of the annual rainfall in Queensland is received during the summer months. In areas with an annual rainfall lower than 25 inches and with a high rate of evaporation of soil moisture, crop production is hazardous without supplementary irrigation.

Explanation of Terms.

The meaning of most terms used in the tables is obvious, and the only ones in which confusion in interpretation may arise are "green feed" and "food."

The term *green feed* is used where the crop can be cut and fed immediately in the green state to farm animals. The term *food* is used where the crop can be harvested and fed immediately to farm animals, or held in good condition for some time in the field without harvesting if required, or harvested and then stored in farm structures.

It is recognised that individual farmers may use some crops in other ways than indicated in the tables, but the intention here is to name the *main purposes* for which various crops are used.

NORTHERN DISTRICTS.

SOWING AND PLANTING TABLE FOR FIELD CROPS.

(This table requires to be adapted to suit individual circumstances).

Crop.	Main Purpose for Which Grown.	When to Sow or Plant.			How Sown or Planted.				Approximate Period of Growth of Crop in Months.	Remarks.
		Coastal Districts.	Tableland Districts.	Inland Districts.	Distance Rows Apart.	Distance Between Plants.	Quantity of Seed per acre if Drilled.	Quantity of Seed per acre if Broadcast.		
					Ft. In.	Ft. In.				
Arrowroot	Flour and pig food ..	Aug. to Nov.	Sep. to Dec.	Sep. to Dec.	5 0	2 0	10 to 12 cwt. of bulbs	..	8 to 10 ..	Suited best to coastal districts
Artichoke	Pig food	July to Aug.	Aug. to Oct.	Aug. to Oct.	3 6	1 6	4 to 5 cwt. of tubers	..	4 to 5 ..	Difficult to store; will keep better in soil
Barley (Cape and Skinless)	Grazing and green feed	Apr. to June	Feb. to June	Mar. to June	Drilled	..	1 bus. ..	1½ bus. ..	2 to 4 ..	..
Beans, Lima ..	Seed	Mar. to May	Nov. to Jan.	Nov. to Jan.	2 6	0 9	20 to 25 lb.	..	3½ to 4 ..	..
Beans, Navy or Canning	Seed	Mar. to May	Dec. to Jan.	Dec. to Jan.	2 4	0 4	15 to 24 lb. ..	..	3 to 3½ ..	Wider rows for fertile soils
Beet, Silver	Green feed for poultry	Mar. to June	Feb. to June	Feb. to June	2 6	1 0	4 lb. ..	..	3 to 4 ..	..
Broom Millet ..	Brushware	Mar. to July	Nov. to Jan.	Nov. to Jan.	3 6	0 9	3 to 4 lb. ..	..	4½ to 5 ..	..
Buckwheat	Nectar for bees; grain for poultry	Mar. to July	Dec. to Apr.	Dec. to Apr.	2 0	0 3	25 to 30 lb. ..	40 to 45 lb. ..	1½ to 2½ ..	Produces a valuable nectar crop within 6 weeks of planting
Carrot, Field ..	Stock food	Apr. to June	Mar. to June	Apr. to June	1 9	..	2 to 3 lb. ..	..	4 to 5 ..	..
Cassava	Pig food	Aug. to Dec.	Sep. to Jan.	Oct. to Jan.	5 0	2 0	Cuttings used	..	8 to 10 ..	Boil tubers before using; discard water
Cotton	Fibre	Mar. to Apr.	Oct. to Nov.	Oct. to Nov.	3 6	1 0	15 to 20 lb. delinted seed	..	5 to 7 ..	..
Cow Cane	Green feed	Apr. to Sep.	Oct. to Jan.	Oct. to Jan.	5 0	1 6	2 or 3-eyed setts used	..	7 to 9 ..	Suitable for several ratoons
Cowpea*	Seed, grazing and hay	Mar. to Apr.	Nov. to Jan.	Nov. to Jan.	3 0	0 6	6 to 10 lb. ..	15 to 20 lb. ..	3½ to 4½ ..	For green manure purposes, *see* under "Leguminous cover crops," page 362
Garlic	Market	Mar. to May	Apr. to May	Apr. to May	1 6	0 6	..	..	6	..
Grasses (*see* Pastures)										

* The use of bacterial inoculum with most leguminous plants is recommended. Supplies are obtainable from the Department of Agriculture and Stock, Brisbane

NORTHERN DISTRICTS—*continued.*

SOWING AND PLANTING TABLE FOR FIELD CROPS.

(This table requires to be adapted to suit individual circumstances).

Crop.	Main Purpose for Which Grown.	When to Sow or Plant.			How Sown or Planted.				Approximate Period of Growth of Crop in Months.	Remarks.
		Coastal Districts.	Tableland Districts.	Inland Districts.	Distance Rows Apart.	Distance Between Plants.	Quantity of Seed per acre if Drilled.	Quantity of Seed per acre if Broadcast.		
					Ft. In.	Ft. In.				
Leguminous Cover Crops*—										
Blue Lupin	Green manure ..	Autumn ..	Autumn ..	Autumn ..	Drilled	..	1 bus. ..	1½ bus. ..	5	Erect growth
Calopo	Green manure ..	Summer ..	Summer ..	Summer ..	..	..	..	3 lb. ..	18 or more	Long-term cover; creeping growth
Centro	Green manure ..	Summer ..	Summer ..	Summer ..	..	..	..	3 lb. ..	18 or more	Long-term cover; creeping growth
Cowpeas	Green manure ..	Summer ..	Summer ..	Summer .	Drilled	..	20 to 25 lb. ..	25 to 30 lb. ..	3½ to 5 ..	Creeping growth
Cusara Pea ..	Green manure ..	Summer ..	Summer ..	Summer ..	Drilled	..	5 lb. ..	10 lb. ..	5 to 6 ..	Erect growth
Field Pea	Green manure ..	Autumn ..	Autumn ..	Autumn ..	Drilled	..	1 to 1½ bus.	1½ to 2 bus.	3 to 4 ..	Creeping growth
Gambier Pea ..	Green manure ..	Summer ..	Summer ..	Summer ..	Drilled	..	5 lb. ..	10 lb. ..	5 to 6 ..	Erect growth
Mauritius (Velvet Bean)	Green manure ..	Summer ..	Summer ..	Summer ..	3 0	2 0	20 lb. ..	40 to 60 lb. ..	3 to 4 ..	Creeping growth
Poona Pea	Green manure ..	Summer ..	Summer ..	Summer ..	Drilled	..	20 to 25 lb. ..	20 to 30 lb.	3½ to 4 ..	Semi-erect growth
Puero	Green manure ..	Summer ..	Summer ..	Summer ..	..	..	..	3 lb. ..	18 or more	Long-term cover; creeping growth
Rice Bean ..	Green manure ..	Summer ..	Summer ..	Summer ..	Drilled	..	15 to 20 lb. ..	20 to 25 lb. ..	4 to 5 ..	Creeping growth
Soybean	Green manure ..	Summer ..	Summer ..	Summer ..	Drilled	..	20 to 30 lb. ..	25 to 35 lb. ..	3 to 4 ..	Semi-erect growth
Tangier Pea ..	Green manure ..	Autumn ..	Autumn ..	Autumn ..	Drilled	..	10 lb. ..	12 lb. ..	5	Creeping growth
Vetches or Tares ..	Green manure ..	Autumn ..	Autumn ..	Autumn ..	Drilled		¾ to 1 bus.	1 to 1¼ bus.	3½ to 4½ ..	Creeping growth
Linseed (Flax) ..	Seed for oil	Apr. to June	Apr. to June	Apr. to June	Drilled	..	20 to 25 lb. ..	..	4½ to 5 ..	..
Lucerne*	Hay and grazing ..	Apr. to May	Apr. to May	Apr. to May	Drilled	..	10 to 12 lb. ..	14 to 18 lb. ..	3	For grazing in drier arears 4 to 6 lb.; in grass mixtures 1 to 3 lb.
Maize	Grain and stock ..	Mar. to Aug.	Nov. to Jan.	Nov. to Jan.	4 0	1 3	8 to 10 lb. ..	56 lb. for stock food	4 to 5 ..	For stock food closer row and plant spacing with increased seed rate

Pop Corn	Grain	Mar. to Sep.	Nov. to Jan.	Nov. to Jan.	3 6	1 0	5 to 7 lb. ..	..	4	..
Sweet Corn ..	Market	Mar. to Sep.	Nov. to Jan.	Nov. to Jan.	3 6	1 0	6 to 8 lb. ..	..	3	..
Mangel and Sugar Beet	Stock food	Mar. to May	Mar. to May	Mar. to May	2 6	1 0	4 to 6 lb. ..	..	6 to 7 ..	..
Millet (French) ..	Grain	Mar. to Aug.	Nov. to Feb.	Nov. to Feb.	Drilled	..	10 to 14 lb. ..	20 lb. ..	2 to 2½ ..	..
Millet (Giant and Dwarf Setaria)	Grain, hay and grazing	Mar. to Dec.	Nov. to Feb.	Nov. to Feb.	Drilled	..	10 to 14 lb. ..	20 lb. ..	2½ to 3 ..	Can be grazed earlier if required
Millet (Japanese) ..	Hay and grazing ..	Mar. to Dec.	Nov. to Feb.	Nov. to Feb.	Drilled	..	10 to 14 lb. ..	20 lb. ..	2 to 3 ..	Can be grazed earlier if required
Millet (White Panicum)	Grain, hay and grazing	Mar. to Dec.	Nov. to Feb.	Nov. to Feb.	Drilled	..	10 to 14 lb. ..	20 lb. ..	2½ to 3 ..	Can be grazed earlier if required
Oats	Grazing and hay ..	Mar. to June	Feb. to June	Feb. to June	Drilled	..	1¼ bus. ..	1½ to 2 bus.	3 to 5 ..	..
Onion	Market	Apr. to May	Apr. to May	Apr. to May	1 2	3 to 6 in.	1½ to 3 lb. ..	..	5 to 6 ..	..
Panicum (*see* "Millet")										
Pasture Grasses—										
Buffel	Pasture	..	..	Spring and summer	..	..	..	2 to 3 lb. ..	Perennial; summer grower	Suitable for sandy soils in dry areas
Elephant	Pasture and green feed	Sep. to Jan.	Oct. to Jan.	Oct. to Jan.	5 0	2 6	Root and stem cuttings used	..	Perennial; summer grower	Graze or cut frequently to prevent woody stems developing; ratoons vigorously
Guinea (Common, Purple Top and Green Panic)	Pasture	Aug. to May	Oct. to Feb.	Oct. to Feb.	4 0	3 0	Root cuttings used for Common Guinea only	4 to 5 lb. ..	Perennial; summer grower	Provides best pasture if excessive stem development is prevented
Kikuyu	Pasture	Aug. to May	Oct. to Feb.	Oct. to Feb.	3 0	3 0	Runner cuttings used, or plough or disc in chopped runners	..	Perennial; summer grower	..
Mitchell	Pasture	..	..	Spring and early summer	..	..	..	2 to 3 lb. ..	Perennial; summer grower	..
Molasses	Pasture	Aug. to May	Oct. to Feb.	Oct. to Feb.	..	..	..	2 to 4 lb. ..	Perennial; summer grower	Used on scrub burns; needs careful management
Para	Pasture	Aug. to May	Oct. to Feb.	Oct. to Feb.	6 0	6 0	Runner cuttings used; or plough or disc in chopped runners	3 to 4 lb. ..	Perennial; summer grower	..

SOWING AND PLANTING TABLE FOR FIELD CROPS.

(This table requires to be adapted to suit individual circumstances).

Crop.	Main Purpose for Which Grown.	When to Sow or Plant.			How Sown or Planted.				Approximate Period of Growth of Crop in Months.	Remarks.
		Coastal Districts.	Tableland Districts.	Inland Districts.	Distance Rows Apart.	Distance Between Plants.	Quantity of Seed per acre if Drilled.	Quantity of Seed per acre if Broadcast.		
					Ft. In.	Ft. In.				
Paspalum	Pasture	Sep. to Mar.	Oct. to Feb.	Oct. to Feb.	..	..		8 to 12 lb.	Perennial; summer grower	Does not thrive in extreme dry heat; best results from sowing in prolonged showery weather
Prairie	Pasture	Mar. to May	Mar. to May	Mar. to May	..	..	..	20 to 25 lb.	Annual; winter and spring grower	..
Rhodes	Pasture	Sep. to Mar.	Oct. to Feb.	Oct. to Feb.	..	..	..	8 to 12 lb. .	Perennial; summer grower	Best results from sowing in prolonged showery weather
Pasture Legumes— Calopo	Pasture mixtures	Sep. to Dec.		..	.			3 lb. in mixtures	Perennial; summer grower	Less palatable than other tropical legumes
Centro	Pasture mixtures ..	Sep. to Dec.	..	..	..		..	4 lb. in mixtures	Perennial; summer grower	Stock must acquire a taste for this legume
Puero	Pasture mixtures ..	Sep. to Dec.	..	..	12 0	6 0	..	3 lb. in mixtures	Perennial, summer grower	Very palatable
Stylo	Pasture mixtures ..	Sep. to Dec.	..	.	.	..	..	2 lb. in mixtures	Perennial; summer grower	Palatability uncertain; stock must acquire a taste
Townsville Lucerne	Pasture mixtures ..	Sep. to Mar.	Sep. to Mar.	Sep. to Mar.	..	.	.	3 to 4 lb. ..	Perennial; summer grower	..
White Clover ..	Pasture mixtures ..	..	Mar. to May	..	.	..	..	2 lb. in mixtures	Perennial; winter and spring grower	..
Pea, Field*	Stock food and grazing	Apr. to June	Feb. to June	Feb. to June	Drilled		1 to 1½ bus.	1½ to 2 bus.	3 to 4 ..	When sown in combination with a cereal, ½ to ¾ bus. per acre. For green manure purposes, *see* under "Leguminous cover crops," page 362

* See footnote on page 361.

Peanut	Kernels	Mar. to Aug.	Nov. to Jan.	Nov. to Jan.	3 0	1 3	25 to 30 lb. of kernels	..	4 to 5 ..	..
Potato	Market	Apr. to May	July and Jan	July and Jan	3 6	1 0	6 to 8 cwt. of tubers	..	3 to 4 ..	..
Pumpkin	Market and stock food	Mar. to Aug.	Nov. to Jan.	Nov. to Jan.	8 to 12 feet	3 to 4 feet	2 to 3 lb. ..	..	5 to 6 ..	..
Rape	Stock feed	Mar. to June	Mar. to June	Mar. to June	Drilled	..	5 to 6 lb. ..	6 to 8 lb. ..	2½ to 4 ..	..
Rice, Swamp ..	Grain	Nov. to Jan.	Nov. to Jan.	Nov. to Jan.	Drilled	..	80 to 120 lb.	..	4 to 5 ..	Requires constant flooding during growing period
Rice, Upland ..	Grain	Nov. to Jan.	Nov. to Jan.	Nov. to Jan.	Drilled	..	60 to 90 lb. .	..	4 to 5 ..	..
Rye	Grain and grazing ..	Mar. to June	Feb. to June	Feb. to June	Drilled	..	¾ to 1 bus.	1 to 1½ bus.	3 to 5 ..	..
Sorghum, Grain ..	Grain ; stubble grazing	Mar. to Aug.	Nov. to Jan.	Nov. to Jan.	14 to 42 in.	..	4 to 12 lb.	12 to 20 lb. .	3½ to 5	Immature growth of any member of this group may contain poisonous properties ; care should be exercised in grazing
Sorghum, Sweet ..	Stock fodder ..	Mar. to Aug.	Nov. to Jan.	Nov. to Jan.	3 6	0 4	5 to 6 lb. ..	12 to 15 lb. ..	3½ to 5	
Sudan Grass ..	Grazing and hay ..	Aug. to Dec.	Nov. to Feb.	Nov. to Feb.	Drilled	..	8 to 10 lb. ..	10 to 14 lb. ..	2 to 4	
Soybean*	Seed, grazing and hay	Apr. to Sep.	Nov. to Jan.	Nov. to Jan.	2 6	4 to 6 in.	15 to 20 lb. ..	25 to 35 lb. ..	3½ to 4½ ..	Unsuitable for very wet coastal areas
Sunflowers	Seed for oil and bird seed	Apr. to Sep.	Nov. to Jan.	Nov. to Jan.	3 0 or 3 6	1 0	4 to 6 lb. ..	..	4 to 5 ..	Unsuitable for very wet coastal areas ; wider spacing and less seed per acre where hand harvesting adopted
Potato, Sweet ..	Market and stock fodder	All seasons	Oct. to Feb.	Oct. to Feb.	4 0	2 0	Cuttings used	..	4 to 5 ..	Plants in wet coastal areas usually after wet season ; useful for pig raising
Tobacco	Leaf	Mid-May and June	July to Oct.	July to Oct.	4 0	1 6 to 2 0	1/5 oz. in seedbeds	..	3 to 4 ..	Plants must be reared in specially prepared seed-beds and transplanted when strong enough
Turnip (including Swede)	Market and stock food	Apr. to Aug.	Mar. to June	Mar. to June	2 0	1 0	1½ to 2 lb. ..	3 to 4 lb. ..	4 to 5 ..	..
Vetches or Tares ..	Grazing	Apr. to June	Mar. to June	Mar. to June	Drilled	..	30 to 40 lb. ..	40 to 60 lb. ..	3 to 4 ..	For green manure purposes, *see* under "Leguminous cover crops," page 362
Wheat	Grazing and hay ..	Apr. to June	Mar. to June	Mar. to June	Drilled	..	2/3 to 1 bus.	1 to 1½ bus.	3 to 4 ..	Fodder purposes only ; rust-resistant varieties recommended

CENTRAL DISTRICTS.

SOWING AND PLANTING TABLE FOR FIELD CROPS.

(This table requires to be adapted to suit individual circumstances).

Crop.	Main Purpose for Which Grown.	When to Sow or Plant.		How Sown or Planted.				Approximate Period of Growth of Crop in Months.	Remarks.
		Coastal Districts.	Tableland and Inland Districts.	Distance Rows Apart.	Distance Between Plants.	Quantity of Seed per Acre if Drilled.	Quantity of Seed per Acre if Broadcast.		
				Ft. in.	Ft. in.				
Arrowroot	Flour and pig food ..	Aug. to Nov.	Sep. to Oct...	5 0	2 0	10 to 12 cwt. of bulbs	..	8 to 10 ..	Suited best to coastal districts
Artichoke	Pig food	Aug. to Nov.	Sep. to Nov.	3 6	1 6	4 to 5 cwt. of tubers	..	4 to 5 ..	Difficult to store; will keep better in soil
Barley (Cape and Skinless)	Grazing and green feed	Mar. to June	Mar. to June	Drilled	..	1 bus. .	1½ bus. ..	2 to 4 ..	..
Beans, Lima	Seed	July to Jan...	Sep. to Dec...	2 6	0 9	20 to 25 lb. ..	..	3 to 4 ..	..
Beans, Navy or Canning	Seed	Sep. to Jan...	Sep. to Jan...	2 4	0 4	15 to 24 lb. .	..	3 to 3½ ..	Wider rows for fertile soils
Beet, Silver	Green feed for poultry	Mar. to June	Mar. to June	2 6	1 0	4 lb. .. .	..	3 to 4 .	..
Broom Millet ..	Brushware	Sep. to Dec...	Sep. to Dec...	3 6	0 9	3 to 4 lb. ..	..	4½ to 5 ..	..
Buckwheat	Nectar for bees; grain for poultry	Aug. to Mar.	Aug. to Mar.	2 0	0 3	25 to 30 lb. ..	40 to 45 lb. ..	1½ to 2½ ..	Produces a valuable nectar crop within 6 weeks of planting
Canary Seed	Hay, green feed and grain	Mar. to June	Mar. to June	Drilled	..	10 to 15 lb. ..	20 to 25 lb. ..	4½ to 5 ..	Not recommended for grain in this zone
Carrot, Field	Stock food	Mar. to June	Apr. to May	1 9		2 to 3 lb. ..	..	4 to 5 ..	..
Cassava	Pig food	Aug. to Oct.	Sep. to Oct.	5 0	2 0	Cuttings used ..	..	8 to 10 ..	Boil tubers before using; discard water
Cotton	Fibre..	Sep. to Nov.	Sep. to Nov.	3 6	1 0	15 to 20 lb. delinted seed	..	5 to 7 ..	..
Cow Cane	Stock food	July to Dec.	Sep. to Dec. .	5 0	2 0	2 or 3-eyed setts used	..	7 to 9 ..	Suitable for several ratoons
Cowpea*	Seed, grazing and hay	Sep. to Jan...	Oct. to Jan...	3 0	0 6	6 to 10 lb. .	15 to 20 lb. ..	3½ to 4½ ..	For green manure purposes, *see* "Under Leguminous cover crops," page 367

* *See* footnote on page 361.

Garlic	Market	Mar. to May	Mar. to May	1 6	0 6	..	..	6	..
Grasses (*see* Pasture)									
Leguminous Cover Crops*—									
Blue Lupin ..	Green manure ..	Autumn ..	Autumn ..	Drilled	..	1 bus. ..	1¼ bus. ..	5	Erect growth
Cowpeas	Green manure ..	Summer ..	Summer ..	Drilled	..	20 to 25 lb. ..	25 to 30 lb. ..	3½ to 4 ..	Creeping growth
Cusara Pea ..	Green manure ..	Summer ..	Summer ..	Drilled	..	5 lb.	10 lb.	5 to 6 ..	Erect growth
Field Pea	Green manure ..	Autumn ..	Autumn ..	Drilled	..	1 to 1¼ bus. ..	1½ to 2 bus. ..	3 to 4 ..	Creeping growth
Gambia Pea ..	Green manure ..	Summer ..	Summer ..	Drilled	..	5 lb.	10 lb.	5 to 6 .	Erect growth
Mauritius (Velvet) Bean	Green manure ..	Summer ..	Summer ..	3 0	2 0	20 lb. . ..	40 to 60 lb. ..	5	Creeping growth
Poona Pea	Green manure ..	Summer ..	Summer ..	Drilled	..	20 to 25 lb. .	20 to 30 lb. .	3½ to 4 ..	Semi-erect growth
Rice Bean	Green manure ..	Summer ..	Summer ..	Drilled	..	15 to 20 lb. ..	20 to 25 lb. ..	4 to 5 ..	Creeping growth
Soybean	Green manure ..	Summer ..	Summer ..	Drilled	..	20 to 30 lb. ..	25 to 35 lb. ..	3½ to 4 ..	Semi-erect growth
Tangier Pea ..	Green manure ..	Autumn ..	Autumn ..	Drilled	..	10 lb.	12 lb.	5	Creeping growth
Vetches or Tares ..	Green manure ..	Autumn ..	Autumn ..	Drilled	..	¾ to 1 bus. .	1 to 1¼ bus. .	3½ to 4½ ..	Creeping Growth
Linseed (Flax) ..	Seed for oil	Apr. to June	Apr. to June	Drilled	..	20 to 25 lb. ..	..	4½ to 5 ..	..
Lucerne*	Hay and grazing ..	Apr. to May	Apr. to May	Drilled	.	10 to 12 lb. ..	14 to 18 lb. .	3	For grazing in drier areas, 4 to 6 lb.; in grass mixtures, 1 to 3 lb.
Maize	Grain and stock food	Aug. to Dec.	Sep. to Dec. .	4 0	1 3	8 to 10 lb. ..	56 lb. for stock food	4 to 5; for stock food 3 to 4	For stock food closer row and plant spacing with increased seed rate
Pop corn	Grain	Sep. to Jan...	Oct. to Jan...	3 6	1 0	5 to 7 lb. ..	..	4	..
Sweet Corn ..	Market	Sep. to Jan...	Oct. to Jan...	3 6	1 0	6 to 8 lb. ..	..	3	..
Mangel and Sugar Beet	Stock food	Feb. to May..	Mar. to May	2 6	1 0	4 to 6 lb. ..	..	6 to 7 ..	..
Millet (French) ..	Grain	Sep. to Jan.	Oct. to Jan..	Drilled	..	10 to 14 lb. ..	20 lb.	2 to 2½ ..	..
Millet (Giant and Dwarf Setaria)	Grain, hay & grazing	Aug. to Feb.	Sep. to Feb...	Drilled	..	10 to 14 lb. ..	20 lb.	2½ to 3 ..	Can be grazed earlier, required
Millet (Japanese) ..	Hay and grazing ..	Aug. to Feb.	Sep. to Feb...	Drilled	..	10 to 14 lb. ..	20 lb.	2 to 3 ..	Can be grazed earlier, required

* *See* footnote on page 361.

CENTRAL DISTRICTS—*continued*

SOWING AND PLANTING TABLE FOR FIELD CROPS

(This table requires to be adapted to suit individual circumstances)

Crop	Main Purpose for Which Grown.	When to Sow or Plant: Coastal Districts.	When to Sow or Plant: Tableland and Inland Districts	How Sown or Planted: Distance Rows Apart	How Sown or Planted: Distance Between Plants	How Sown or Planted: Quantity of Seed per Acre if Drilled	How Sown or Planted: Quantity of Seed per Acre if Broadcast	Approximate Period of Growth of Crop in Months	Remarks
				Ft in	Ft in				
Millet (White Panicum)	Hay and grazing	Aug to Feb	Sep to Feb	Drilled		10 to 14 lb	20 lb	2½ to 3	Can be grazed earlier, if required
Oats . .	Grazing, hay and grain	Mar to June	Mar to June	Drilled		1¼ bus	1½ to 2 bus.	3 to 5	
Onion . .	Market . .	Apr. to May	Apr. to May	1 2	3 to 6 in	1½ to 3 lb		5 to 6	. .
Panicums (*see* Millets)									
Pasture Grasses—									
Blue Panic	Pasture .	Sep to Mar	Sep to Feb				4 lb	Perennial, summer grower	Graze heavily and intermittently once established
Buffel . .	Pasture . .	Sep to Mar	Sep to Mar				4 to 5 lb	Perennial, summer grower	Sandy or deep soils best, lighter sowing rate in the west on sandy country
Elephant . .	Pasture and green feed	Sep to Feb	Oct to Jan	5 0	2 6	Root and stem cuttings used		Perennial, summer grower	Graze or cut frequently to prevent woody stems developing, ratoons vigorously
Guinea (Common Guinea and Green Panic)	Pasture	Sep to Mar	Oct to Feb	2 0	2 0	Root cuttings used for Common Guinea	4 to 5 lb	Perennial, summer grower	Graze to maintain young growth, but allow resting period
Kikuyu .	Pasture . . .	Sep. to Feb	Oct to Feb	3 0	3 0	Runner cuttings used or plough or disc in chopped runners		Perennial, summer grower	Only Tableland areas in northern part of Central district
Mitchell	Pasture		Spring and early summer				2 to 3 lb	Perennial, summer grower	Trample in seed with sheep

Molasses	Pasture	Sep. to Mar...	Oct. to Feb...	..	..	..	2 to 4 lb. ..	Perennial; summer grower	Used on scrub burns; needs careful grazing; suitable only in limited areas; frost susceptible
Para	Pasture	Sep. to Feb...	..	6 0	6 0	Runner cuttings used, or plough or disc in chopped runners	3 to 4 lb. ..	Perennial; summer grower	Used in swamps or where water supply ample or ground always damp
Paspalum	Pasture	Sep. to Mar...	..	..	..	..	8 to 12 lb. ..	Perennial; summer grower	Best growth where rainfall exceeds 40"
Prairie	Pasture	Mar. to May	Mar. to May	..	..	..	20 to 25 lb. ..	Annual; winter and spring grower	May regenerate if allowed to seed
Rhodes	Pasture	Sep. to Mar...	Oct. to Mar...	..	..	..	8 to 12 lb. ..	Perennial; summer grower	Sown on summer burns; best results from sowing in prolonged showery weather
Pasture Legumes— Black Medic ..	Pasture mixtures ..	Autumn ..	Autumn ..	..	..	..	2 to 3 lb. in mixtures	Annual or biennial	Growth extends into summer; may regenerate
Phasemy Bean ..	Pasture mixtures ..	Spring and summer	Spring and summer	..	..	..	5 to 7 lb. in mixtures	Annual; summer grower	Regenerates; may be useful in Rhodes grass country
Townsville Lucerne	Pasture mixtures ..	Spring ..	..	..	..	..	5 to 6 lb. in mixtures	Annual; summer grower	Regenerates
Stylo	Pasture mixtures ..	Spring ..	..	..	..	..	5 lb. in mixtures	Perennial; summer grower	..
White Clover ..	Pasture mixtures ..	Early autumn	Early autumn	..	..	..	2 lb. in mixtures	Perennial; winter and spring grower	Best suited to high Tableland areas, *e.g.*, Eungella
Pea, Field*	Stock food and grazing	Mar. to June	Apr. to June	Drilled	..	1 to 1¼ bus. ..	1½ to 2 bus. ..	3 to 4 ..	When sown in combination with a cereal, ½ to ¾ bus. per acre; for green manure purposes, *see* under "Leguminous cover crops," page 367
Peanut	Kernels	Sep. to Dec. .	Sep. to Dec...	3 0	1 3	25 to 30 lb. of kernels	..	4 to 5 ..	..
Potato	Market	June and Jan.	June and Jan.	2 6	1 0	6 to 8 cwt. of tubers	..	3 to 4 ..	..
Pumpkin	Market and stock food	Sep. to Jan...	Sep. to Jan...	8 to 12 feet	3 to 4 feet	2 to 3 lb. ..	..	5 to 6 ..	Plantings in the Mackay-Bowen area are made usually after the summer wet season

* *See* footnote on page 361.

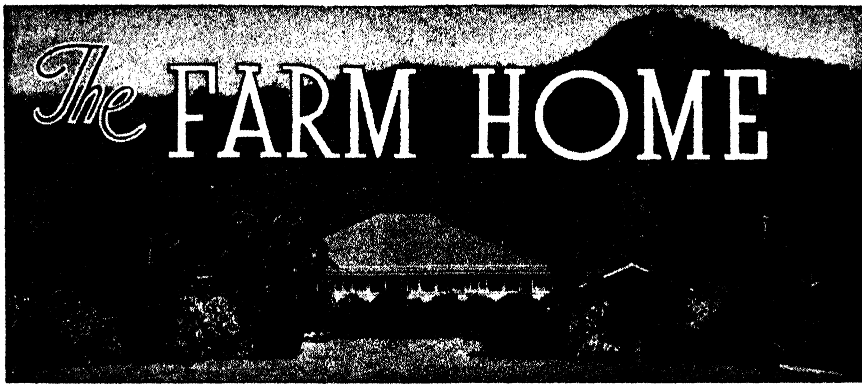
CENTRAL DISTRICTS—*continued.*

SOWING AND PLANTING TABLE FOR FIELD CROPS.

(This table requires to be adapted to suit individual circumstances).

Crop.	Main Purpose for Which Grown.	When to Sow or Plant.		How Sown or Planted.				Approximate Period of Growth of Crop in Months.	Remarks.
		Coastal Districts.	Tableland and Inland Districts.	Distance Rows Apart.	Distance Between Plants.	Quantity of Seed per Acre if Drilled.	Quantity of Seed per Acre if Broadcast.		
				Ft. in.	Ft. in.				
Rape	Stock food	Mar. to May	Mar. to May	Drilled	..	5 to 6 lb.	6 to 8 lb. .	2½ to 4 .	..
Rice, Swamp	Grain	Oct. to Jan. .	Oct. to Jan. .	Drilled	.	80 to 120 lb.	..	4 to 5 .	Requires constant flooding during growing period
Rice, Upland ..	Grain	Oct. to Jan...	..	Drilled	..	60 to 90 lb. .	..	4 to 5 ..	..
Rye	Grain and grazing ..	Mar. to June	Apr. to June	Drilled	..	¾ to 1 bus. .	1 to 1¼ bus. ..	3 to 5 ..	..
Sorghum, Grain ..	Grain; stubble grazing	Sep. to Feb...	Sep. to Jan...	14 to 42 in.	..	4 to 12 lb. ..	10 to 20 lb. ..	3½ to 5	Immature growth of this group may contain poisonous properties; care should be exercised in grazing
Sorghum, Sweet ..	Stock food	Sep. to Feb...	Sep. to Feb. .	3 6	0 4	5 to 6 lb. ..	12 to 15 lb. ..	3½ to 5	
Sudan Grass	Grazing and hay ..	Sep. to Feb. .	Sep. to Jan...	Drilled	..	8 to 10 lb. ..	10 to 14 lb. ..	2 to 4	
Soybean*	Seed, grazing and hay	Sep. to Jan.	Oct. to Jan..	2 6	4 to 6 in.	15 to 20 lb. ..	25 to 35 lb. .	3½ to 4½	For green manure purposes, *see* under "Leguminous cover crops," page 367
Sunflowers	Seed for oil and bird seed	Sep. to Jan...	Sep. to Jan.	28 or 35 in.	1 0	4 to 6 lb. ..	..	4 to 5 ..	Wider spacings and less seed per acre where hand harvesting adopted
Sweet Potato ..	Market and stock food	Sep. to Feb...	Sep. to Dec...	4 0	2 0	Cuttings used ..	..	4 to 5 ..	Plantings in the Mackay-Bowen area are made usually after the summer wet season; useful for pig grazing
Tobacco	Leaf	Sep. to Dec...	Sep. to Dec. .	4 0	18 to 24 in.	1/5 oz. in seed-beds	..	3 to 4 from transplanting	Plants must be raised in specially prepared seed-beds, and transplanted to permanent positions when strong enough
Turnip (including Swede)	Market and stock food	Feb. to May..	Feb. to May..	2 0	1 0	1½ to 2 lb. ..	3 to 4 lb. ..	4 to 5 ..	..
Vetches or Tares* ..	Grazing	Mar. to June	Mar. to June	Drilled	..	30 to 40 lb. ..	40 to 60 lb. ..	3 to 4 ..	For green manure purposes, *see* under "Leguminous cover crops," page 367
Wheat	Grain, grazing and hay	Apr. to June	Apr. to July	Drilled	..	¾ bus. ..	1 to 1¼ bus. ..	3 to 6 ..	Fodder purposes only on coast where rust resistant varieties are recommended

* *See* footnote on page 361.



The Baby's Need for Mothering.

HOW many mothers "enjoy" their first babies—or for that matter any subsequent babies they may have? Has all the instruction issued by the various authorities concerned with the very important task of reducing the numbers of deaths and the amount of ill-health in babies served to make conscientious parents feel that it is their duty to bring their babies up according to a strict plan which must not be departed from and in which it is wrong for a baby to be cuddled, rocked, or talked to at any time?

Smaller families, the greater participation of mothers in social and other activities outside the home, and lack of home help may be contributory causes, but the fact remains that many babies are "mothered" only at feed times and not always then if they are bottle fed.

This is entirely wrong. Every human being needs to feel loved and wanted, and nowhere is this more evident than in the response of the young baby to cuddling and caressing. It is not uncommon to see bonny little babies, left for long periods to the care of more or less indifferent strangers by mother's social activities or outside employment, become in time pale, flabby, and uninterested in what is going on around them.

Doctors and nurses who work in large institutions where children remain for any length of time know how easy it is for small babies to become retarded mentally and physically because they cannot have the intimate personal care and individual attention which they receive in a happy family circle and to which they can respond. Such institutional babies adopted into private homes often bloom so quickly in response to love and mothering that even the most inexperienced person can see the change. From this it will be realised that loving handling and mothering of a baby are absolutely necessary for this growth and development, both physical and mental. Babies who are allowed to lie all day passively in cots will quickly become languid and wasted. This does not say that baby should be nursed all the time he is awake and played with until he becomes excited and over-stimulated, but he certainly should not be left for too long unnoticed or in the same position. He should be turned from side to side or propped up with pillows so that he can watch what is going on around him. A change of position is a relief and rest for baby just as it is for older people. With careful planning of household duties every mother should find some times in each day when she can talk to and play with her baby for a few minutes in a calm and happy way so that he does not become over-excited.

A baby who is fed by his mother is always "mothered" at feed times, and equally so an artificially fed baby should never be allowed to lie in his cot while taking his bottle. He should be cuddled and held in a position as nearly as possible like that of the baby being fed at his mother's breast. An outing each day is good for mother and baby alike. If it could be made practicable for every girl to receive advice and instruction in the handling of little babies as part of her education we should have more families able to "enjoy" their children even from their early baby days.

Any further information on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's terrace, Brisbane, or by addressing letters, "Baby Clinic, Brisbane." These letters need not be stamped.

ASTRONOMICAL DATA FOR QUEENSLAND.

JULY, 1950.

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Date.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6·39	5.03	Cairns	9	49	Longreach ..	27	43
6	6·39	5.05	Charleville	25	29	Quilpie	37	33
11	6·39	5.07	Cloncurry	37	63	Rockhampton ..	1	19
16	6·38	5.10	Cunnamulla ..	32	27	Roma	15	19
21	6·36	5.12	Dirranbandi ..	22	16	Townsville ..	8	41
26	6·34	5.15	Emerald	12	28	Winton	29	51
31	6·31	5.17	Hughenden ..	21	49	Warwick	5	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Date.	Rise.	Set.
	p.m.	a.m.
1	6.28	7.56
2	7.35	8.44
3	8.38	9.24
4	9.38	9.58
5	10.34	10.29
6	11.27	10.57
7	..	11.25
	a.m.	
8	12.20	11.53
		p.m.
9	1.14	12.23
10	2.08	12.56
11	3.04	1.34
12	4.01	2.18
13	4.57	3.07
14	5.51	4.02
15	6.41	5.01
16	7.26	6.03
17	8·06	7.04
18	8.42	8.05
19	9.16	9.05
20	9.47	10.05
21	10.19	11.07
22	10.52	a.m.
23	11.29	12.11
	p.m.	
24	12.11	1.18
25	12.59	2.27
26	1.56	3.36
27	3.00	4.43
28	4.08	5.42
29	5.16	6.34
30	6.21	7.18
31	7.23	7.55

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).
Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	29	10	45	24	20	0	52	27
6	18	19	34	35	9	10	38	41
11	11	29	26	44	0	20	7	52
16	11	28	26	43	0	19	7	52
21	20	16	37	31	11	7	42	36
26	30	9	46	23	21	0	54	26
31	23	14	39	29	14	4	45	33

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	53	4	67	33	50	19	44	5
3	43	13	59	39	44	24	36	13
5	31	24	51	46	35	31	25	21
7	21	34	44	54	29	39	18	29
9	16	39	41	57	26	42	14	34
11	7	52	36	65	20	50	7	44
13	2	56	33	67	17	53	3	46
15	3	53	34	66	18	51	4	44
17	11	45	38	60	23	46	10	37
19	21	34	44	54	29	39	18	29
21	33	22	52	45	37	30	27	19
23	44	16	61	41	45	26	37	15
25	54	5	67	34	51	20	44	6
27	56	2	68	32	52	17	46	8
29	50	6	64	34	48	20	41	7
31	39	16	56	41	41	26	33	15

Phases of the Moon.—Last Quarter, July 7, 12.53 p.m.; New Moon, July 15, 3.05 p.m.; First Quarter, July 22, 8.50 p.m.; Full Moon, July 29, 2.17 p.m.

On 15th July, the Sun will rise and set 25 degrees north of true east and true west respectively, and on the 6th and 20th the Moon will rise and set at true east and true west respectively. On the 5th the Sun will be at its furthest distance from the Earth—94,600,000 miles.

Mercury.—At the beginning of the month, in the constellation of Taurus, will rise about 1 hour before the Sun, and on the 11th will be in line with the Sun, after which it will pass into the evening sky. By the end of July, in the constellation of Leo, it will set about 1½ hours after the Sun.

Venus.—In the constellation of Taurus at the beginning of the month, when it will rise 2½ hours before sunrise, but by the end of the month, in the constellation of Gemini, will rise 1¾ hours before the Sun.

Mars.—Still in the constellation of Virgo on the 1st, it will set about midnight, while on the 31st it will set about 1 hour before midnight.

Jupiter.—In the constellation of Aquarius, in the eastern evening sky, at the beginning of the month will rise between 9.15 p.m. and 10.30 p.m. At the end of the month it will rise between 7.20 p.m. and 8.45 p.m.

Saturn.—In the constellation of Leo, will set between 10 p.m. and 11.30 p.m. at the beginning of July and between 8.15 p.m. and 9.30 p.m. at the end of July.

Vol. 70 Parts 1 to 6

QUEENSLAND AGRICULTURAL JOURNAL

GENERAL INDEX.

INDEX TO ILLUSTRATIONS.

AUTHOR INDEX.

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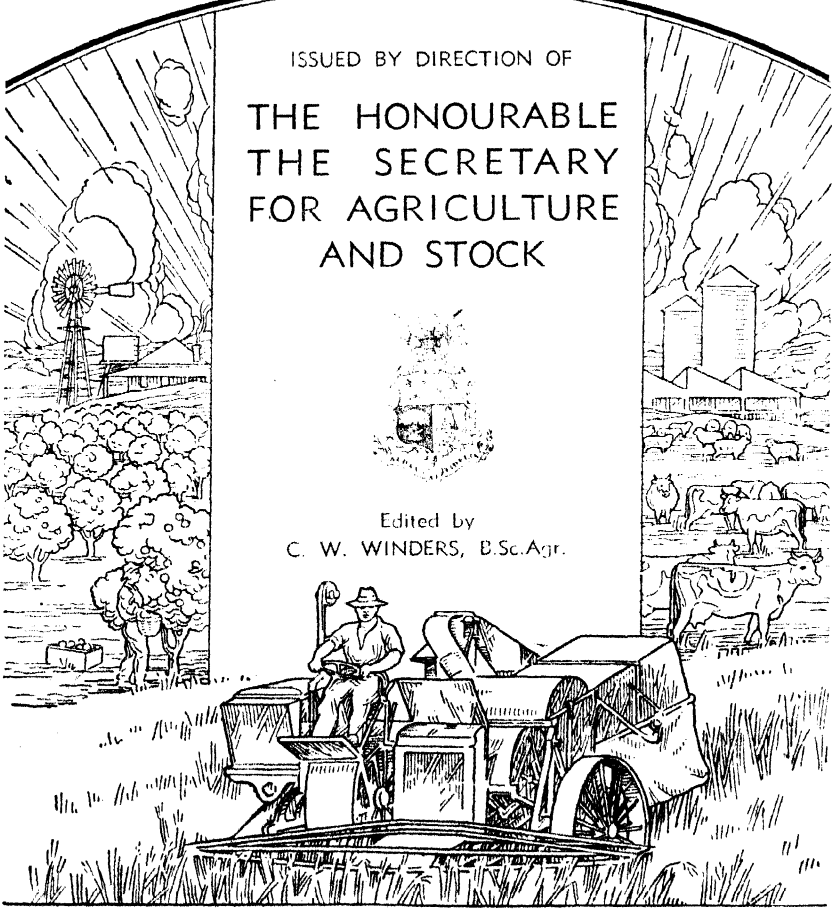
Edited by

C. W. WINDERS, B.Sc.Agr.



JULY to DECEMBER, 1950

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GOVERNMENT PRINTER, BRISBANE

Contents

Wheat Growing in Queensland.

C. S. CLYDESDALE (Senior Adviser in Agriculture) and L. G. MILES (Senior Plant Breeder).

(*Continued from page 337 of the June issue.*)

HARVESTING.

THE crop is ready for harvesting when the grain has become hard and dry; this can normally be ascertained by biting or by noting the effect of pressure with the thumb nail. Should the crop have ripened unevenly, the grain tested should be taken from the latest maturing section of the field. Ripe grain which has been dampened by rain must be allowed to harden again before it is harvested. Once the grain is in satisfactory condition for harvesting, no time should be lost in getting the crop off, as the risks of severe loss through hail and thunderstorms in Queensland districts are very real at this period of the year.

The advent of the modern header-harvester has greatly increased the safety factor at this critical period This machine, which cuts, threshes and cleans the grain in one operation, has revolutionised wheat harvesting. Even its predecessor, the stripper, which itself provided a great advance upon previous harvesting methods, was much slower in operation and more limited in its effectiveness. Where soil was damp at harvest time the stripper was unable to remove the heads without pulling whole plants out of the ground, resulting in choking of the comb. Again, where crops were badly lodged by storms the stripper was powerless to deal with them. The modern header, on the other hand, has proved itself able to handle expeditiously, and with little loss of grain, crops which are weedy, badly lodged, or poorly anchored in moist soil.

Many makes of machines, all eminently suited for local conditions, are available on the Queensland market. The swathe cut by such machines ranges from 6 feet to 14 feet. Most machines of standard type may be hauled by either horse teams or tractors, but tractors are almost universally used now on account of the steadier power output, the greater possible speed and the longer hours that can be worked.

The operating machinery in most of the earlier harvesters was driven from the main cleated wheel of the harvester. Such machines sometimes fail in loose soil because of wheel slip. Another disadvantage is that when the "going" is heavy and tractor speed has to be reduced by the use of a lower gear, the threshing speed is correspondingly reduced, with the result that congestion may occur unless a narrow cut is taken. These disadvantages are largely overcome by replacing the

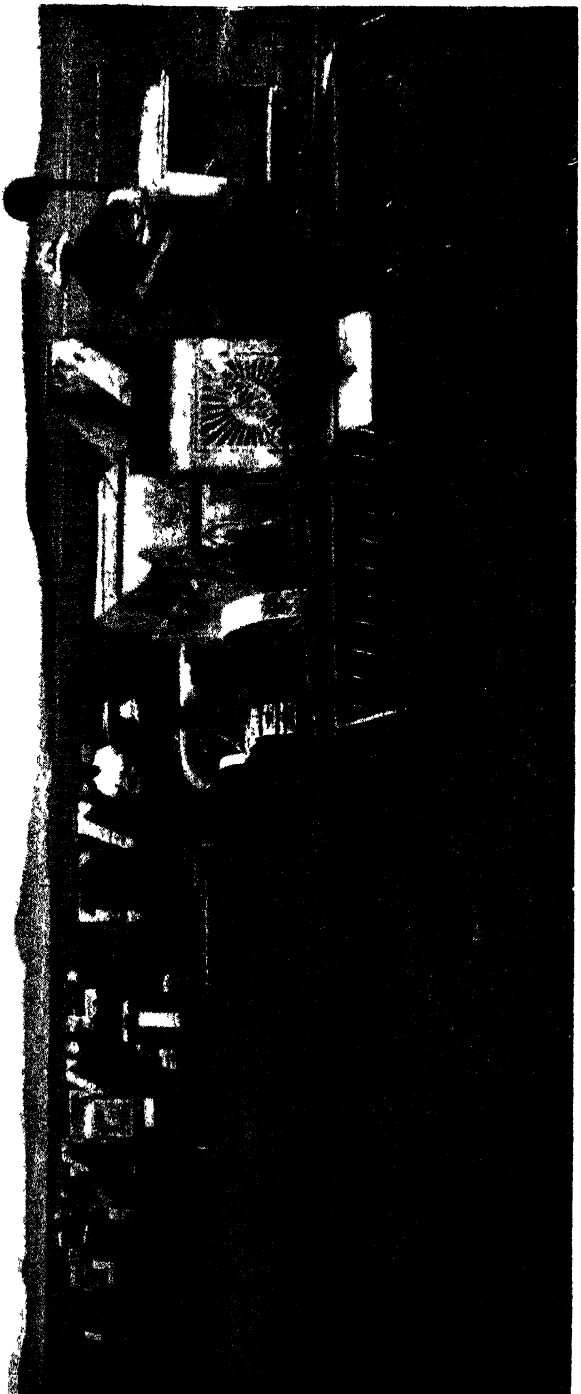

Plate 1.

Harvesting Wheat at Evanslea, Darling Downs.—An autoheader is followed by a number of tractor-drawn headers. This crop, though lodged and somewhat tangled, was satisfactorily harvested without the need for crop-lifters.

wheel-drive with a power take-off direct from the tractor. Harvesters equipped with power take-off normally operate far more efficiently than wheel-driven machines, particularly in heavy crops, in badly lodged or tangled crops, or on moist or loose soil. The necessity for power take-off is obviated if an engine-functioned header is available. This type carries its own engine, the purpose of which is to operate the functional parts of the header, but not to provide locomotion; either horse teams or light tractors may provide the motive power. Such machines, which are used for harvesting rice in southern irrigation areas, are not often encountered in Queensland wheat districts, but could be very useful on hillsides or on loose sandy land. The most expensive type of header, and that which is most efficient and labour-saving on large wheat farms, is the auto-header (Plate 1). These machines contain a built-in tractor which supplies all power requirements, including that of locomotion. The last three modifications of the general harvester type enable the machines to be used if required as stationary plants for threshing or re-cleaning of seed.

Crop-lifters, which can be readily attached to all standard machines, enable them to operate successfully in badly lodged and tangled crops. By this means, such crops, which were once written off as almost total failures, may now be harvested with little or no grain loss.

The one undesirable feature about the header-harvester in careless hands is its ability to harvest crops in which the grain is immature or otherwise carrying too high a moisture content. When an attempt was made in earlier days to harvest such crops with stripper-type machines, the choking of the comb indicated that the crop was not in condition to harvest, and compelled a cessation of operations. The harvesting of grain in an immature or moist condition does not save time, for the grain must be spread out, dried and rebagged, if total loss is to be avoided. Damp wheat will not be accepted by the Wheat Board's classifiers under any consideration. In addition, it should be remembered that wheat which is only slightly moist is far more susceptible to weevil attack than hard, dry, fully matured grain.

MARKETING.*

Progress in the industry has not been confined to production methods but has also extended to the marketing of the crop. The first step in this direction was taken in December, 1920, with the establishment of The State Wheat Board to handle the 1920-21 Queensland crop.

Once the Board was set up it became compulsory for all growers in the State to deliver their wheat to the Board, which undertook the storage and sale of the commodity and paid advances to growers from time to time on wheat delivered. The State Wheat Board is empowered under *The Wheat Pool Acts*, 1920 *to* 1930 to operate for limited periods, and provision is made for a poll of growers if required, at the expiration of such periods, to obtain approval for the continuance of the Board.

Such has been the confidence of growers in the Board that on each occasion on which such a poll has been conducted an overwhelming majority of growers has voted in favour of its continuance. The operation of the Acts at present extends to cover the 1949-50 season. The control of the Board is in the hands of growers, the present membership comprising four elected grower members, the Director of Marketing, and an independent Chairman.

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* This section prepared by Division of Marketing.

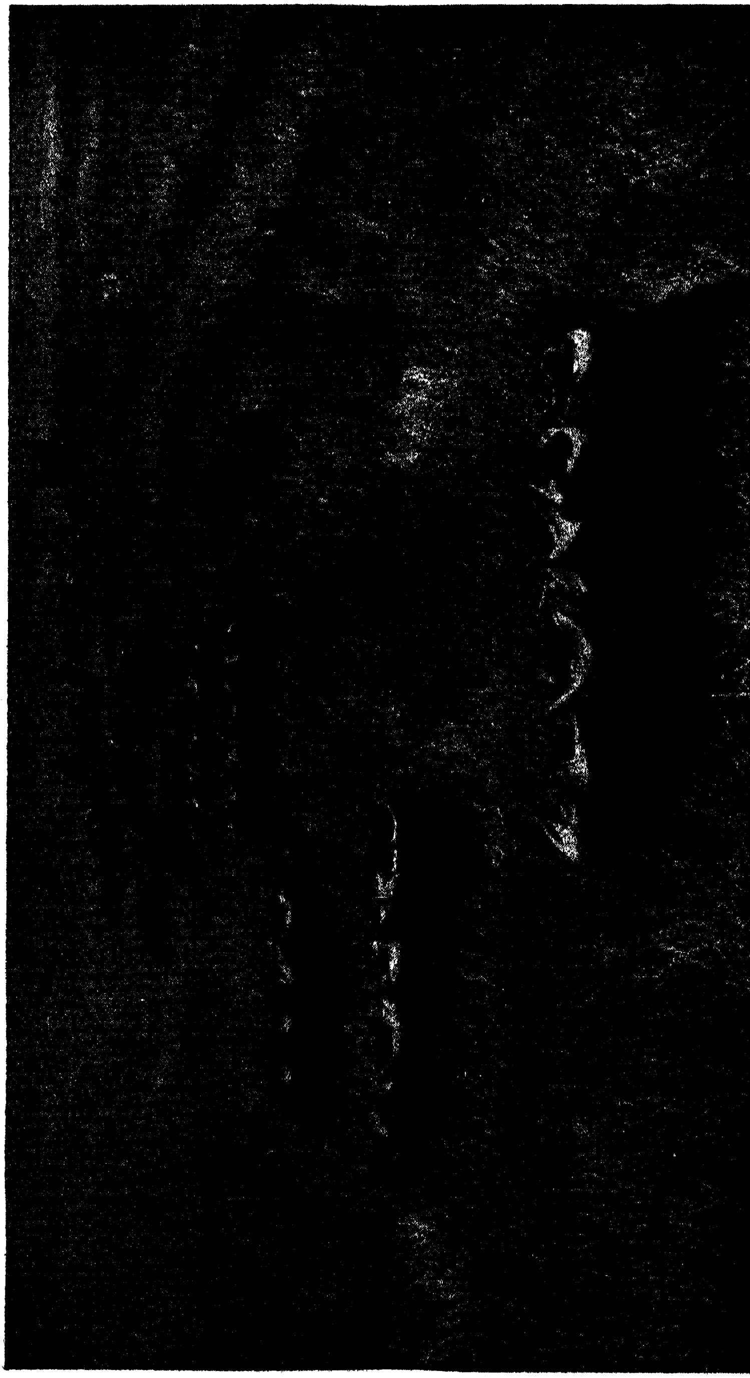

Plate 2.

Bagged Wheat Ready to be Sewn on a Bongeen Farm.

The activities of the Board are not confined entirely to the marketing of the crop. A compulsory co-operative hail insurance scheme is in operation which provides that all wheat grown in Queensland is, subject to completion of the required return, insured against hail damage on a scale provided in the hail insurance regulations. The scheme is financed by means of a levy on wheat harvested.

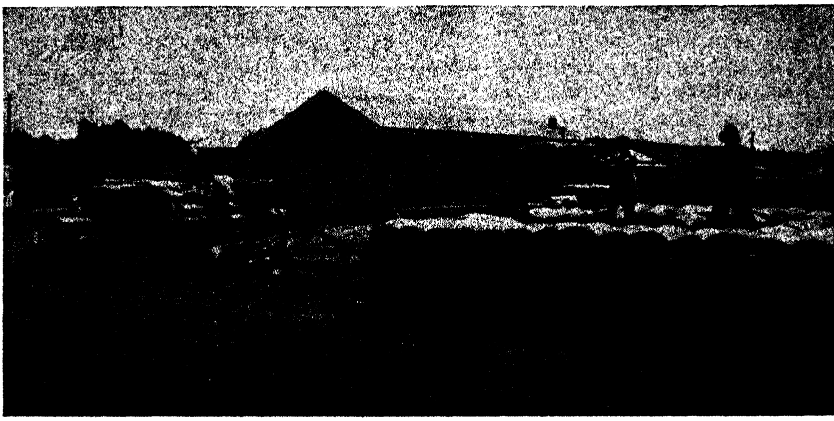

Plate 3.

Building a Wheat Dump at a Railway Siding.

Receiving, Classifying, and Grading.

The State Wheat Board operates a system of classifying the wheat grown in the State into Q1, Q2, and Q2A grades of milling wheat, and feed wheat. Queensland is the only State which has adopted such a classification system, all other States operating on the FAQ standard.

As wheat is delivered at the receiving depot (Plate 3) a Board classifier draws a fair sample of wheat from each bag and separates the load into the several grades. The wheat is then stacked and stored until required for outward delivery. A grower has the right to appeal for revision of classification if he is not satisfied with the original grading of his wheat.

The classification system is based on a visual examination of the wheat, the general requirements of the grades being as follows:—

Q1.—Wheat which is bright, dry and free from foreign substances, with good condition and colour, and of superior milling quality in every respect.

Q2.—Wheat which complies with the requirements for Q1 grade but which may contain foreign grains and substances which could be separated during milling; or wheat which is to some extent bleached, or pinched through dry conditions. This grade does not admit grain which has germinated.

Q2A.—Wheat of milling quality which cannot be admitted to Q1 or Q2 grades.

Feed Wheat.—Wheat which is not suitable for milling because of Hexham scent, or which is smutty, musty, excessively pinched or of generally low quality.

Queensland flour millers pay to The State Wheat Board premiums at the rates of 3d. and 1½d. per bushel for Q1 and Q2 wheat respectively,

which is supplied to them. The monies obtained from such premiums are used for the payment of premiums to growers who deliver such wheat.

Australian Wheat Board.

At the outbreak of war in 1939, all wheat grown in Australia was subject to acquisition under the National Security (Wheat Acquisition) Regulations. Under these Regulations the Australian Wheat Board became the prime authority for the marketing of wheat in Australia, and during, and for a short time after the war, the Queensland State Wheat Board acted only as agent and licensed receiver for the Australian Board. However, under the Wheat Industry Stabilisation Scheme which was introduced to commence with the 1947-48 season, the State Wheat Board is preserved as a separate entity and works in conjunction with the Australian Wheat Board, so that the industry is now organised on a national as well as a State basis. This scheme provides for guaranteed returns to growers until the 1952-53 season.

Further progress towards the stabilisation of the wheat industry has been accomplished with the operation of an international wheat agreement which now provides a measure of stability in the export market.

REDUCING FIRE RISKS.

Though the harvested grain, through the operations of the State Wheat Board, is automatically insured against loss by fire, this cover in respect of fire risks does not extend to the standing crop The premiums required by insurance companies transacting this class of business are high, but the risk must be acknowledged to be a very real one with results that can be disastrous.

Ripening crops have been destroyed as a result of bush fires or grass fires getting out of control, through being struck by lightning during a dry storm, or through careless use of matches; furthermore, the risk has tended to increase with the universal use of tractors. It is an essential precaution, therefore, for growers to ensure that, if an outbreak of fire does occur, it will be localised as far as possible Under most conditions, protection can be afforded by cutting a strip about half a chain in width all round the field, and ploughing or discing the stubble. Where large areas are cropped, the same procedure should be adopted, but in addition tracks of similar width should be cut through the crop in such a manner as to divide it into say 200-acre blocks. Cutting of these protective strips is best accomplished with a reaper-and-binder when the crop is at the hay stage. The sheaves obtained may be set aside for use by farm stock, or sold as hay or chaff if not locally required.

Should it be likely that a binder will not be available when required for this purpose, strips may be left unsown at the beginning of the season, or failing this, the young plants may be destroyed by cultivation to form the necessary breaks For such breaks to be efficient, however, they must be kept cultivated and free of weed growth.

SHEEP AND WHEAT.

Sheep raising and wheatgrowing can be combined very economically on suitable land. The proposition becomes practicable only on the larger farms where ample uncultivated land is available for carrying the sheep when they cannot have access to the areas under immediate cultivation. Sheep have many uses on a large grain farm, and they are essentially easy to maintain. One of their main uses is in keeping

fallows clean. By this means they reduce the number of cultivations required, and the weeds which would otherwise be a serious liability are converted into a considerable asset.

Furthermore, in the event of a young wheat crop becoming too rank in growth or too forward as a result of seasonal or soil conditions, the sheep may be used to graze the crop, thereby reducing the probability of loss through lodging or frost injury. It is customary, where sheep are held, to plant slow-maturing varieties early in the season with the specific purpose of obtaining one or more grazings, and then, should the weather be favourable, allowing a grain crop to mature.

Plate 4

Sheep Grazing on Wheat on the Darling Downs.

No inflexible rule can be laid down regarding the number of sheep that can be profitably carried on a given acreage. Much depends upon the soil type, the rainfall, the size of the holding, the improvements, and the major object in view, whether stock or crop husbandry. There are instances, however, on the western Darling Downs of farms of about 1,200 acres, half of which is under crop, mainly wheat with a small area devoted to lucerne, carrying comfortably over a number of seasons up to 1,000 sheep.

Where a wheat crop has been fed off by sheep, it is advisable after the sheep have been removed to loosen the soil surface by running a set of heavy harrows over the field. By this means the soil mulch which has been destroyed by the grazing stock is restored. Stock should not of course be permitted to graze a crop, particularly on the heavier soils, when the ground is wet. If the crop is intended ultimately for grain, sufficient sheep should be used to graze it down as rapidly as possible. Where the number of sheep is small in comparison with the area to be grazed, there is a tendency for the stock to remain on the one spot, since they frequently prefer the regrowth to the ranker ungrazed material.

There is a stage in the growth of the wheat crop beyond which it is fatal to graze if a grain harvest is desired. This stage may be ascertained by taking a number of average stalks, dismembering them, and examining them closely for the undeveloped ear. If this miniature ear can be discerned, the crop is too far advanced to be further grazed as a dual purpose crop. On the Darling Downs feeding-off may usually be permitted with safety until the end of July, while in the Maranoa or more northerly districts grazing should be discontinued by the end of June. Crops have under exceptional circumstances been grazed until the end of August and still produced satisfactory grain yields, but such occurrences are not common.

Observations over a number of years support the view that feeding-off does not tend to increase the ultimate grain yield. Much depends upon the availability of moisture in the soil and the occurrence of rain subsequent to grazing, but in general, lower grain yields would be expected following the practice. In specific instances, however, this form of management does result in useful grain yields which might otherwise have been seriously reduced through excessive leafiness, lodging or frosting.

MOTTLING IN WHEAT.

Mottling in wheat is characterised by the occurrence together in individual grains of both hard (vitreous) sections and soft (floury) sections. While mottling has been prevalent in Queensland only in recent years, it has been reported from older wheat-producing countries from quite early times. In North America, where most of the grain produced is of the "hard red" class, this manifestation is commonly referred to by the name of "yellow-berry."

Mottling has been reliably reported by Queensland millers to cause a serious reduction in the bread-making quality of the milled flour. Its prevalence, therefore, in recent years has caused considerable concern, and the Department is engaged in a research programme seeking to find the causes of this trouble and practical methods for its correction.

While it is premature to try to anticipate the results of this investigation, the following points appear to have been fairly well established as a result of studies made elsewhere and of preliminary observations in Queensland.

(1) Mottling is not so much a cause as a symptom of reduced quality in wheat, the causes being definitely associated with soil fertility and crop management.

(2) Only grain types which are normally vitreous (or translucent) can mottle, and it is this group of wheats which includes all those of highest baking strength.

(3) Even normally vitreous varieties differ in their susceptibility to mottling. It should be remembered, however, that the conditions which cause mottling in one variety may cause a comparable loss in quality in a second variety, even though the latter is much less subject to mottling.

(4) The degree of mottling can be varied considerably by fertilizer and cultural treatments. Mottling is normally worse on eroded slopes and old cultivations than upon fertile soil which has been well fallowed.

(5) While other plant foods may be shown to have marked effects upon mottling, nitrogen is almost certainly the main determining factor. Upon the nitrogen taken up from the soil depends the quantity of gluten present in the mature grain. Where the nitrogen supply is insufficient in grains of normally translucent appearance, deterioration in texture occurs, giving the characteristic symptoms of mottling.

While these conclusions are probably valid for Queensland as for other countries, they do not offer any easy solution to the problem. The application of nitrogen as a fertilizer at planting time may not necessarily prove wholly effective or economic. It is clear that the problem is tied up with the whole system of wheat culture in the main grain-producing areas of the Darling Downs, and therefore considerable research may be necessary to provide remedial measures which will be both effective and acceptable to farmers.

WHEATS FOR GRAZING AND FOR HAY.

While in this State wheat is mainly grown for its grain yield, there are some 50,000 acres used annually for grazing and also nearly 10,000 acres grown for hay. Much of the area used for grazing is probably planted for grain production, and eventually fed off as a result of (i.) shortage of other green feed or grazing on the farm; or (ii.) a decision that the grain crop would probably fail on account of dry weather. As a winter grazing crop, wheat is second in importance to oats, and as a hay crop second to lucerne.

Where wheat is grown for hay or green feed, rust resistance is an important requirement in the variety chosen, particularly in the higher rainfall districts or districts which are close to the coast. Moreover, while quick-maturing wheats often offer the best prospects of grain yields in the more inland agricultural areas, slower-maturing varieties will normally provide higher hay yields or a more extended grazing season in the near-coastal dairying districts. For these reasons Florence x College suggests itself as a worthwhile variety for use for either grazing or hay in the more favoured dairying districts; its resistance to leaf-rust (in addition to stem-rust) gives it a big advantage over most other varieties, and it has proved under farm conditions to be very palatable to stock. Warput is a proven grazing wheat of some years' standing, but it suffers by comparison with Florence x College in its lower degree of rust resistance. In addition, its weaker straw would place it at a disadvantage as a hay wheat under conditions which are conducive to heavy growth. Other wheats which are worthy of trial for these purposes are Celebration, Charter, Kendee, and "Fedweb-5." Bearded wheats such as Three Seas or Seafoam should not be chosen for either grazing or hay-making.

Hay-making is discussed more fully in other Departmental publications. Best results with wheat are obtained by cutting during the early heading period, not later than a week after flowering. The presence of well formed grain in wheaten chaff generally indicates that the material has passed its most nutritious stage, and also invites destruction by mice and other vermin.

Crops may be cut with the reaper-and-binder, stooked in the field until satisfactorily cured, and finally stored in barns or stacked. Alternatively, they may be cut with a mower, allowed to cure in the swath, and converted into baled hay by use of a pick-up hay baler. The latter process, particularly where a one-man baler is available, is the most economical of human time and labour. As in making other types of hay, it is essential that the material should carry no free moisture when it is baled or stacked. The presence of excess moisture will cause overheating in a large stack of any type, and has frequently resulted in complete loss through spontaneous combustion. Only experience can provide a guide as to the correct stage at which to bale loose hay, or cart in sheaves for stacking. With wheat, however, the best criterion is the drying out and shrinkage of the upper nodes (or joints) of the straw. Where material is in the stook, handfuls of straw should be extracted from the middle of a number of inside sheaves for use in making this test.

MAJOR WEED PESTS.

Wild Oats.*

This weed, which is, as its name implies, a wild representative of the oat group, is one of the commonest pests of winter cereal crops the

* *Avena fatua.*

world over. The plant is very similar in its field appearance to cultivated oats, and is readily distinguished from them only by its mature seeds, which are enveloped by a tough, black, hairy chaff, and carry a strong, angled awn (or beard). The hard seed-covering enables the seed to lie in contact with moist soil for long periods of time without germinating. Even seeds favourably placed near the surface of the soil will not all germinate on the one rain, for which reason it is never possible to control the pest by a single cultivation. The wild oat also requires cooler soil conditions than most of the cultivated cereals for its germination.

Main disadvantage of the pest is that it occupies space in the wheatfield which would otherwise be producing wheat, and competes with neighbouring wheat plants for soil moisture and nutrients; the presence of a large population of wild oats in a wheat crop may represent a serious reduction in potential yield of the wheat. Secondly, although the wild oat has a shorter growing period than most wheats, its delayed germination may result in its producing a mass of green heads at the time the wheat is ready for harvest. Inclusion of the green oats in the bags of wheat would endanger the quality of the grain by overheating, while, if the crop is allowed to stand until the oats are ripe, serious losses or deterioration may occur through unfavourable weather. Thirdly, where the wild oat crop matures at approximately the same time as the wheat, its seed provides an important impurity which requires mechanical removal before the wheat can be milled for flour. Also, much of the seed will normally have shed before harvesting, providing a constant source of re-infestation of the land.

As with most weeds, the most effective control measure is prevention of its initial entry. Where new land or clean land is planted, care should be exercised in the selection of seed which is completely free of this pest. Grading machines of modern design can make a very effective separation of oats from wheat, and where planting seed cannot be obtained from perfectly clean land, it should be carefully graded in some such reliable machine. Care should also be taken to see that this pest is not introduced with wheat or other cereal grains used as stock food.

Where wheatfields are already infested with wild oats, control is not always easy, particularly where wheat is grown annually for grain, following the short fallow. Some measure of control has been claimed by the early sowing of mid-season or later-maturing wheat varieties. Since the wild oat requires a cooler temperature for its germination than the wheat, the early-planted crop may reach a stage at which it can suppress the wild oat before a heavy germination of the latter has occurred. Attempts at control have also been made by planting late, following several cultivations aimed at destroying successive weed crops. This method is seldom very successful because delayed germination enables portion of the seed to survive a large number of germination periods.

Where the long fallow is practised (either regularly or in rotation), wild oat control should be relatively simple. Cultural operations during the winter fallow period should be aimed at providing a seed-bed of fine tilth which will encourage germination of the oats when soil temperatures are favourable. Successive crops may then be destroyed by grazing or by further cultivation Whichever method is adopted to destroy the seedling growth, it should be followed by harrowing in order to re-establish the desired tilth.

Another method open to the large-scale grain farmer is to change for some years to summer cropping, using the winter cultivation periods as a means of eradicating the pest. Suitable summer cash crops for mechanical handling are grain sorghum, Sudan grass, sunflowers, and millets. The smaller-scale mixed farmer has still better opportunities for crop rotation, since the use of winter grazing and hay crops and short-term pastures can also be made to assist directly in the eradication of the pest.

Wild Turnips.*

These distinctive, yellow-flowered weeds, which in favourable seasons cover whole roadsides and stock-routes as well as infesting wheatfields, belong to the well-known cabbage and turnip family. Apart from being a weed pest of winter crops they provide one of the commonest causes of taint in milk and cream.

Fortunately, this family of plants is particularly susceptible to even light applications of hormone weedicides. The selective nature of this agent makes the destruction of the pest in cereal crops a simple matter. Farmers have been quick to recognise the fact and over the past two seasons considerable areas of turnip-infested cereal crops have been successfully treated.

Experience has shown that wild turnips can be killed at all stages of growth, but generally the most effective treatment is that given when the plants are young and leafy. One pound acid equivalent mixed with 100 gallons of water is generally regarded as sufficient to treat approximately 6 acres.

Material applied at the above rate will cost only approximately 2s. 6d. per acre (April, 1950, costs). Treatment costs, such as labour, petrol and plant depreciation, are relatively light due to the fact that under normal working conditions it should be possible to cover up to 20 acres per hour with a spray of moderate size attached to a motor truck.

Hexham Scent.†

This weed belongs to the same group as the sweet clovers (or Bokhara clovers), and possesses the strong sweet smell which is characteristic of this group. It is an annual weed which is very prevalent in certain wheat cultivations, and is also widespread along railway enclosures and roadsides throughout the Downs. Its growing period is much the same as that of wheat, and the presence of harvested pods or seeds in the wheat bags imparts to the grain the characteristic scent of the weed. Grain so tainted is not acceptable for milling, as the taint is carried through to the flour and eventually to the bread or other end-product.

As with other winter weeds, control can be easily effected by the use of the long fallow or the introduction of summer cropping for a season or two. Where it is intended to continue with the growing of wheat in an infested area, control may be obtained by spraying the wheat crop with a selective hormone weedkiller while the Hexham scent plants are still young.

Climbing Buckwheat or Black Bindweed.‡

This climbing weed pest with a small black angular seed has recently become very widespread on the Darling Downs. As it is one of a group

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* Mainly *Raphanus raphanistrum* and *Rapistrum rugosum*.

† *Melilotus indica.*

‡ *Polygonum convolvulus.*

of weeds which has proved to be resistant to the commercial hormone weedkillers, its wide spread is causing wheatgrowers much concern.

Climbing buckwheat is frequently carried in wheat seed from infested areas, but there is little excuse for its spread by this means, as the seed is very easily graded out of wheat. If only clean wheat is sown, there should be no danger of introducing the pest to clean paddocks. Control may, of course, be effected by the introduction of the long fallow or of summer crop rotations. There is also a possibility that the dinitro weedkillers may prove effective against this pest, but the practicability of field-scale control in wheat by this means has not yet been fully investigated.

Frost Occurrence in Agricultural Areas.

THE crop planting tables prepared by officers of the Agriculture Branch of the Department and published in recent issues of the Journal stress that certain crops are damaged by frosts and that time of planting must be considered in relation to the expectation of early and late frosts.

Information on frost occurrence in the agricultural and adjacent areas, compiled by Mr. J. C. Foley, of the Commonwealth Meteorological Bureau, and published originally in the Bureau's Bulletin No. 32 in 1945, is summarised here as a guide to Queensland producers.

In presenting the information in Bulletin No. 32, Mr. Foley wrote "..... It is considered that in view of the range of temperature which is critical for various crops susceptible to damage, and the variability of temperature differences between the ground and the thermometer screen under frosty conditions, a screen temperature of 36 deg. F. should provide a fair general basis for statistics of light to moderate frosts at or near ground level, while a screen temperature of 32 deg. may be adopted to give similar information for the level of foliage, blossom and setting fruit at a height of approximately 4 feet above the ground and heavy frosts on the ground."

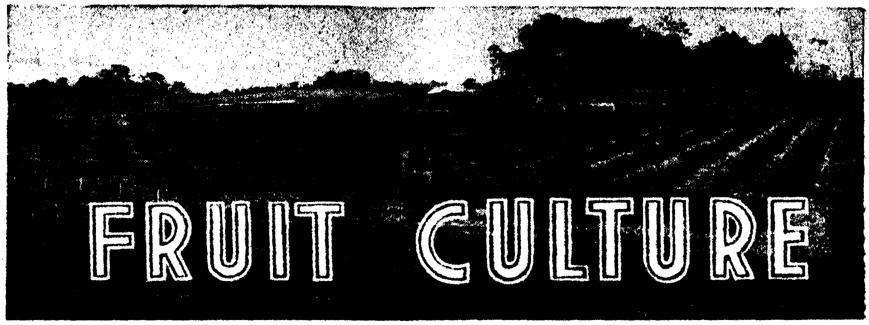
The accompanying table shows, for both light and heavy frosts, the earliest and latest dates on which frost has occurred, the periods during which the first and the last frosts usually occur, and the average frost-free period. A number of centres (including Ayr, Bowen, Bundaberg, Charters Towers, Childers, Rockhampton, and Southport) which have recorded occasional frosts are excluded from the table, as they may be regarded as being virtually frost-free.

The original tables prepared by Mr. Foley were based on records from official recording stations, which in many centres are the post offices. The surrounding districts may or may not experience the same frosts.

FROST OCCURRENCE AT VARIOUS CENTRES.

Station.	Light Frost—Screen Temperature 36°.				Heavy Frost—Screen Temperature 32°.				Average Frost-free Period (Days).
	Earliest on Record.	Usual First.	Last on Record.	Usual Last.	Earliest on Record.	Usual First.	Last on Record.	Usual Last.	
Atherton	Apr. 29	May 28—July 6	Oct. 2	July 10—Aug. 29	May 27	June 6—July 18	Sept. 13	July 18—Aug. 23	316
Biloela	Apr. 22	May 10—June 6	Oct. 5	Aug. 13—Sept. 10	May 18	June 6—July 6	Oct. 5	Aug. 13—Sept. 11	252
Bybera	Apr. 6	Apr. 13—Apr. 27	Oct. 23	Sept. 27—Oct. 11	Apr. 14	Apr. 21—May 1	Oct. 23	Sept. 9—Oct 9	197
Camboova	Mar. 29	Apr. 18—Apr. 30	Nov. 17	Sept. 24—Oct. 12	Mar. 29	Apr. 24—May 28	Oct. 10	Sept. 11—Sept. 29	202
Charleville	Apr. 22	May 16—June 30	Oct. 2	Aug. 16—Sept. 11	May 26	June 6—June 28	Sept. 13	July 26—Aug. 27	273
Clermont	Apr. 28	June 11—July 1	Sept. 10	July 22—Aug. 19	May 15	June 22—Aug. 5	Aug. 25	July 10—Aug. 13	319
Dalby	Apr. 17	May 3—June 2	Oct. 1	Sept. 4—Sept. 22	May 8	June 6—June 28	Sept. 16	Aug. 11—Sept. 4	246
Emerald	Apr. 28	June 8—July 8	Sept. 11	Aug. 4—Aug. 26	May 26	June 15—July 25	Aug. 25	July 11—Aug. 6	311
Gatton College	Apr. 17	May 29—July 6	Sept. 13	July 29—Aug. 30	June 7	June 19—July 23	Aug. 21	July 5—July 25	306
Gayndah	Apr. 24	May 31—June 18	Oct. 12	Aug. 19—Sept. 4	May 14	June 10—June 28	Sept. 17	July 8—Aug. 9	285
Goondiwindi	Apr. 17	May 19—June 12	Oct. 16	Aug. 19—Sept. 8	May 19	June 10—July 20	Sept. 13	July 13—Aug. 24	274
Gympie	Apr. 24	June 1—June 21	Sept. 19	Aug. 15—Sept. 8	May 15	June 16—July 14	Sept. 9	July 6—Aug. 13	287
Herberton	Apr. 29	June 21—July 15	Sept. 30	July 8—Aug. 15	June 21	June 26—July 20	Sept. 12	July 7—July 25	340
Ipswich	May 21	June 10—July 8	Sept. 3	July 31—Aug. 17	June 11	..	Aug. 24	..	319
Killarney	Mar. 29	Apr. 19—May 11	Nov. 17	Sept. 14—Oct. 10	Apr. 17	Apr. 27—June 2	Oct. 21	Aug. 31—Sept. 20	214
Maryborough	June 5	June 14—June 24	Aug. 31	July 5—Aug. 6	June 25	..	July 16	..	332
Miles	Apr. 17	Apr. 28—June 5	Oct. 21	Sept. 10—Oct. 4	Apr. 24	June 3—June 17	Oct. 5	Aug. 21—Sept. 11	238
Mitchell	Apr. 11	Apr. 21—May 21	Oct. 12	Sept. 9—Oct. 1	Apr. 24	May 20—June 17	Oct. 10	Aug. 16—Sept. 11	227
Mount Morgan	May 25	June 12—July 22	Aug. 26	July 21—Aug. 10	June 25	..	Aug. 15	..	335
Nanango	Mar. 26	Apr. 21—May 24	Nov. 6	Sept. 13—Oct. 7	Mar. 26	May 29—June 18	Oct. 12	Sept. 2—Sept. 28	225
Pittsworth	Apr. 17	May 6—June 17	Oct. 12	Aug. 16—Sept. 17	May 25	June 11—July 5	Sept. 3	July 31—Aug. 20	267
Roma	Apr. 17	May 7—June 4	Oct. 12	Sept. 6—Sept. 30	May 2	May 27—June 20	Sept. 22	Aug. 9—Aug. 31	244
Stanthorpe	Mar. 15	Mar. 31—Apr. 21	Nov. 17	Sept. 28—Oct. 24	Apr. 8	Apr. 16—May 16	Nov. 5	Sept. 19—Oct. 9	180
Tamborine Mountain	June 2	June 14—July 8	Sept. 29	July 12—Aug. 17	June 2	..	June 21	..	330
Toowoomba	Mar. 29	May 6—June 9	Oct. 13	Aug. 28—Sept. 17	Apr. 17	May 29—July 3	Sept. 16	July 31—Sept. 4	257
Wallangarra	Mar. 29	Apr. 14—May 8	Nov. 17	Sept. 21—Oct. 15	Mar. 29	May 1—June 10	Nov. 8	Sept. 8—Oct. 14	204
Warwick	Apr. 10	Apr. 24—May 30	Oct. 12	Sept. 10—Sept. 30	Apr. 17	May 23—June 16	Oct. 12	Aug. 20—Sept. 15	233

In most years temperatures do not fall to 32° at Ipswich, Maryborough, Mount Morgan or Tamborine Mountain.



Horticultural Districts of Queensland.

4. Metropolitan.

C. N. MORGAN, Senior Adviser in Horticulture.

THE metropolitan horticultural district embraces roughly all districts within a radius of 25 miles of Brisbane, together with Tamborine Mountain and the Moreton Bay Islands. It is bounded in the east by the waters of Moreton Bay, in the south by the Logan River, in the west by a line parallel to and approximately 25 miles from the coast, and in the north by the Caboolture River. The area includes a number of soil types and a wide range of altitudes varying from Tamborine Mountain, which is about 1,000 feet high, to Pinkenba and Nudgee, which are only a few feet above sea level.

The Brisbane River divides the district into two distinct sections, which are the north and south metropolitan advisory districts. In the former, the main production centres are Pinkenba, Nudgee, Redcliffe, Sandgate, Kallangur, Bald Hills, Aspley, Brookfield, Moggill, Mitchelton and Enoggera, whilst to the south are the Bay Islands, Redland Bay, Cleveland, Wellington Point, Manly, Rochedale, Sunnybank, Eight Mile Plains, Darra, Slacks Creek and Tamborine Mountain.

CLIMATE.

The climate (Table 1) is mainly sub-tropical. The annual rainfall is approximately 45 inches but is slightly higher immediately along the coast and at Tamborine Mountain, and a few inches lower along portions of the western boundary. Approximately half the annual rainfall is received during the summer months of December to March. The bulk of the vegetable production has ended when the wet season commences, and unless the rains extend into late March, they do not interfere to any great extent with land preparation for autumn crops. During the winter, the rainfall is spread out fairly evenly and is usually sufficient for crop growth in non-irrigated areas. A failure of the winter rains, however, does not affect production unduly, as vegetables are largely grown under irrigation and most orchard and plantation crops and trees make little growth at that time of the year.

The prevailing winds are mainly south-east to east in late summer and autumn. During July and August, cold westerly winds blow strongly and may interfere with fruit setting in some crops and often injure the plants. North-easterly to north-westerly winds blow between

October and December. When not accompanied by storms, they are often extremely dry. Windbreaks are a distinct advantage where natural protection is missing.

TABLE 1.

CLIMATIC DATA FOR METROPOLITAN AREA.

BRISBANE.

—	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
Mean Max. Temp. (°F.) ..	85·4	84·5	82·3	79	73·6	69·3	68·5
Mean Min. Temp. (°F.) ..	68·9	68·6	66·3	61·5	55·3	51	48·5
Average Rainfall (points) ..	651	625	571	375	283	285	223

—	Aug.	Sept.	Oct.	Nov.	Dec.	Average.
Mean Max. Temp. (°F.) ..	71·3	75·7	79·7	82·8	85·1	78·1
Mean Min. Temp. (°F.) ..	49·9	54·8	60·0	64·2	67·4	59·7
Average Rainfall (points) ..	204	200	256	368	486	Total= 4,527

TAMBORINE MOUNTAIN.

Mean Max. Temp. (Annual)	70·6 degrees F.
Mean Min. Temp. (Annual)	55·8 degrees F.
Average Rainfall (Annual)	5,431 points

Most of the district enjoys an insular climate, the mean maximum temperature reaching its peak in January with 85·4 deg. F. and its minimum during July at 68·5 deg. F. The land is in production for the greater portion of the year and frosts occur but rarely on the cultivated coastal strip, with the exception of Lower Nudgee and Pinkenba.

SOILS.

Generally speaking, the soils of the metropolitan area are not particularly fertile, and many of them are unsuitable for cultivation. Characteristically, therefore, small groups of farms are often separated by large tracts of poor country.

The most important soils are the red to brown earths overlying a red subsoil containing ironstone (Plate 5). These deep, well drained soils are usually intensively farmed. Red to reddish brown basaltic soils with a loam to clay loam texture are found along the coast from Redland Bay in the south, through Cleveland and Wellington Point, to Redcliffe in the north, and also on some of the Bay islands. These soils are less fertile than they appear, even in their virgin state. They are well drained, easily prepared for cropping, and respond quickly to fertilizers. Many of the farms in these districts have been worked intensively for up to 70 years and, where skilfully managed, are still very productive. A deficiency of trace elements such as boron, zinc, and molybdenum has been noticed in many crops. The red loams readily "fix" phosphates and phosphatic fertilizers are therefore usually applied in bands in the crop row. The main crops on the red loams are bananas, custard apples, papaws, tomatoes, cabbage, lettuce, beans, strawberries, carrots, and beetroot.

Plate 5.

Red Earth at Ormiston.—The cover crop being ploughed in is pigeon pea

Plate 6

Irrigated Strawberry Crop.—The variety is Phenomenal and the crop is 10 weeks old. Skinner spray system in operation at left.

Reddish brown loams and sandy loams in the higher parts of Rochedale, Sunnybank, Eight Mile Plains, Manly, Aspley, Nudgee, and Slacks Creek are mostly deep and well-drained with a red sandy-clay loam subsoil. They are easy to work but are not fertile and need heavy applications of fertilizer. The main crops are papaws, figs, custard apples, tomatoes, strawberries, cauliflowers, carrots, parsnips, lettuce, and beetroot.

Perhaps the largest group of soils are the podsolised, shallow, greyish-white, sandy loams with a heavy subsoil. In many cases, drainage is poor and the land is difficult to cultivate, particularly after heavy rain when the soil dries out slowly and weed growth is a major problem. As these soils often occur in areas where frosts are rare, they are used for vegetables and pineapples and the crops are usually planted on hills to improve the drainage. Soils of this type may be found in such localities as Kallangur, Capalaba, Kingston, and portions of Rochedale, Sunnybank, Oxley, and Park Ridge .

The soils in the hilly country west of the city are closely associated with the Brisbane schists and are usually grey to red-brown in colour, and of loam to clay-loam texture. The surface soils often contain gravel, are shallow but well drained, and overlie a gravelly subsoil. The terrain of the country is steep and erosion could be a problem. Some areas at Pullenvale and Brookfield are fairly fertile and grow very good papaws, pineapples, and bananas. Although water for irrigation is available, the steep and rocky country is not suitable for small crops.

The main alluvials are at Pinkenba, Myrtletown, Lower Nudgee, and along the Pine River, where the soil is a fertile, dark, silty-clay loam. The soil is shallow and overlies a few inches of clay below which is a great depth of fine sand. Excessive rains in the early part of the year affect the drainage and make cultivation difficult. The main crops are cauliflowers, grapes, peaches, tomatoes, melons and pumpkins. Practically no irrigation is practised, as the underground water is saline. Small pockets of alluvial soils along the banks of numerous small creeks through the districts are chiefly used for the production of such crops as rhubarb, radish, silver beet, and lettuce.

On Tamborine Mountain the soil is a basaltic red loam, easily worked but subject to erosion, and the main crops are cauliflowers, beans, and citrus. Avocadoes promise well, but only a small acreage is as yet under crop.

On soils other than those used for pineapples liming is a common practice, as practically all are normally acid with a pH below that preferred for the bulk of the crops grown.

Where water supplies are available, irrigation is practised during the comparatively dry winter and spring. Most of the easily accessible surface water flows through poor country and few of the better farms can use it. Consequently, irrigation is mainly dependent on bore or well supplies. The underground water is tapped at from 40 to 100 feet and the flow is variable. The minimum required from a well or bore is about 1,000 gallons per hour. Where the flow is inadequate for pumping direct through the spray lines, a reservoir or dam may be built. The reservoir is filled from the well or bore and the water is then fed to the spray lines, a single power unit operating the two pumps. Irrigation is comparatively new to the metropolitan districts; one of the first irrigation plants was installed in the Redlands area

TABLE 2.

ESTIMATED HORTICULTURAL PRODUCTION: METROPOLITAN DISTRICT AND TAMBORINE MOUNTAIN, 1948–49.

Crop.	Area.	Estimate of Production.
	Acres.	
Potatoes, English	291	579 tons
Potatoes, Sweet	42	163 tons
Turnips	32	112 tons
Carrots	190	759 tons
Parsnips	16	54 tons
Beetroot	175	673 tons
Tomatoes	1,548	340,392 ½-bushels
French Beans	692	85,367 bushels
Green Peas	177	10,623 bushels
Cabbages	501	140,314 dozens
Cauliflowers	471	115,156 dozens
Lettuce	209	135,891 bushels
Silver Beet and Spinach	6	3,292 dozen bunches
Melons, Water	192	927 tons
Melons, Rock	47	109 tons
Pumpkins	800	3,086 tons
Squashes and Marrows	105	624 tons
Cucumbers	309	38,988 bushels
Other Vegetables	66	..

Crop.	Not Bearing.	Bearing.	Estimate of Production.
	Number of Trees.		
Oranges	2,829	5,512	5,925 bushels
Lemons	2,266	2,160	2,513 bushels
Mandarins	830	482	626 bushels
Grapefruit	288	116	287 bushels
	Area—Acres.		
Grapes (Table)	66	158	379,074 lb.
lantation Fruits—			
Bananas	410	871	76,510 1¼ bushel cases
Pineapples (Factory)	441	1,111	763 tons
Pineapples (Other)	..	..	105,892 1¼ bushel cases
Papaws	163	313	149,400 bushel cases
Passion Fruit	31	52	7,910 ½ bushel cases
Strawberries	31	82	447,862 lb.
	Number of Trees.		
Orchard Fruits—			
Custard Apples	3,127	10,721	28,195 bushels
Mangoes	537	692	790 bushels
Peaches	925	2,730	1,735 bushels
Nuts	9,476	2,059	13,360 lb.

approximately 30 years ago. Owing to the small amounts of water available, irrigation is mainly confined to the fixed overhead perforated pipeline system. Though expensive to install, the system is permanent and quite suitable for vegetable production on farms which would not normally exceed 10-12 acres.

VEGETATION.

The greater portion of the district could be described as savannah woodland, with the exception of such areas as Mount Cotton, Brookfield, and Tamborine Mountain, where the vegetation was mainly rain forest. The chief species of trees are a wide variety of gums, bloodwood, tallow-wood, stringybark, and ironbark. Various types of tea-tree thrive on the low-lying badly drained area, whilst many types of wattles are spread throughout the district, growing rapidly after bush fires.

HORTICULTURAL USES.

A perusal of the production data (Table 2) will give some idea of the important part that the metropolitan district plays in supplying the vegetable and fruit requirements of Queensland. The area under vegetables has increased over the last 20 years, but little expansion in fruit production can be expected. The proximity of the cropping areas to Brisbane allows the production of a wide variety of perishable crops.

Bananas.

The banana has been a major crop for many years. In the foothills the main varieties are Cavendish and Mons Mare, while the tall-growing Lady Finger is grown mainly on the coast, where plantations are rather exposed and sometimes cold. The banana acreage is declining, due, in the case of the Cavendish and Mons Mare, to the lack of new country suitable for their production, and in the Lady Finger, to the widespread incidence of Panama disease. Bananas respond to irrigation and regular fertilizing, and planting distances are closer under these conditions than in areas depending on normal rainfall: Consequently, the net yield over the crop cycle of the plantation is higher than might be expected from Panama disease affected areas. Bunchy top, a virus disease, is not serious in the Lady Finger variety unless the plantation is neglected, but it still remains the main hazard to production in the other varieties.

Pineapples.

The pineapple area remains fairly static. The main varieties are the smooth leaf Cayenne, the rough leaf Ripley and Common Rough. The first is grown fairly extensively in the Moggill, Brookfield, Dayboro' and Kallangur districts. Brackenridge is a district which grows the rough leaf varieties almost exclusively. Most of the smooth leaf fruit finds its way to the cannery but the smaller rough leaf is sold on the fresh fruit market. The Redland and Rochedale districts were formerly big producers of pineapples but the land is now more profitably employed producing vegetables and, to a lesser extent, papaws.

Strawberries.

Strawberries are grown in almost every part of the metropolitan area and the acreage is increasing yearly. An assured market has been a great stimulus to growers, as the crop is easily produced and a

Plate 7.

Young Papaws at Sunnybank.—The stand will be thinned to the normal 8-feet spacing when 12 months old. Standpipe from underground irrigation main in foreground.

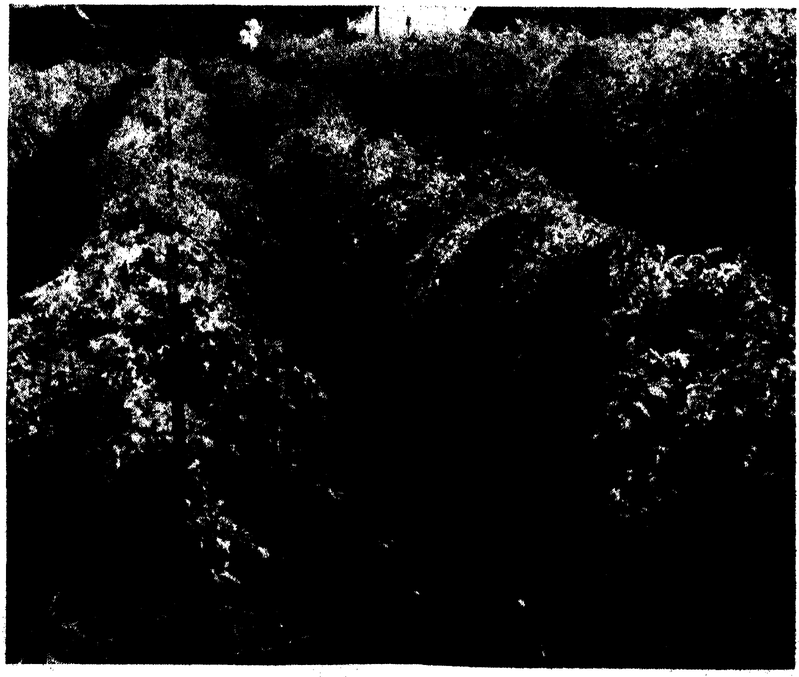


Plate 8.

Ground Crop of Tomatoes.—Note windbreak at right.

profitable return may be expected from it. Planting is done in March and production starts in June, terminating usually in November, Most of the fruit finds its way to the factory and the local fresh fruit market. However, a large interstate trade has been built up for the better class of berry and air transport is used to place the fruit on southern markets in first class condition. For nearly 50 years the main variety grown has been Phenomenal, a type developed in Queensland. It is a vigorous grower with good colour and carries well. Virus diseases are the main trouble, but growers are becoming adept at recognising the affected plants, which are removed and destroyed.

In an effort to produce virus-free stock, certain growers produce approved runners for sale under supervision of the Department of Agriculture and Stock. The main areas of production are Cleveland, Manly, Eight Mile Plains, Ormiston, and Slacks Creek (Plate 6).

Papaws.

Brookfield, Rochedale, and Sunnybank are the biggest papaw production centres and owing to the suitability of soils and climate for the crop are likely to remain so. This crop is troubled by various diseases; the worst, known as "die-back," may shorten the profitable life of the plantation by at least three years. Dioecious types are mainly grown and they vary considerably in shape and size. The eating quality of the fruit varies from good during the peak of the season to rather poor at the beginning and end (Plate 7).

Passion Fruit.

So serious are the diseases affecting passion fruit in the metropolitan district that the crop is now grown only on a limited scale. Some years ago Fusarium wilt wiped out completely the large production centre of Mount Cotton. This disease, together with woodiness and brown spot, has shortened the life of the average plantation to one or two crops. Cleveland is probably the main source of a limited supply.

Custard Apples.

The Redlands area, Sunnybank, and Rochedale have well established custard apple orchards, many of them over 40 years old. These very attractive trees have a most variable cropping habit. There appear to be differences within a variety and a rather rigorous selection of propagating material from regular cropping trees of good type may overcome this undesirable feature.

Little fault can be found with the quality of the fruit of the main variety, Pink's Mammoth, but some other varieties are inferior. Most of the fruit is sold locally on the fresh fruit market, and a lesser quantity is sent interstate. Approximately 16 years ago, many acres of custard apples were pulled out in the Redlands district to make way for bananas. Now that bananas are less profitable, much of the land is once more going back to custard apples. Trace element deficiencies, particularly of zinc, are apparent in most districts and control measures are normally applied by growers.

Figs.

Fig production is confined mainly to the Sunnybank area and the bulk of the crop is sold to factories for jam making. The deep, sandy soils suit the varieties in use, which are mainly self-fertile types such

as Brown Turkey, White Genoa, and White Adriatic. The crop is fairly safe if regular attention is given to the control of insect pests and fungus diseases. A large increase in the acreage is unlikely as the demand for figs is rather limited.

Grapes.

The Pinkenba and Nudgee districts, where grapes are mainly grown, have been in production for at least 60 years. Until recently, grape growing was confined almost entirely to these areas but now it is spreading fairly rapidly into Wellington Point and Darra. Phylloxera made its appearance in the Pinkenba-Nudgee areas approximately 25 years ago and destroyed a large acreage of the vinifera types of grapes, mainly Black Hamburg and Black Muscat, but did little apparent harm to the labrusca types such as Wilder and Iona. The district is quarantined. Phylloxera resistant stocks, mainly 1202 and A.R.G.1, were introduced, and the vineyards reconstructed. Crops from the grafted vines are satisfactory, but in some cases the berries on the young plants colour later than desired. As the vines become older, this trouble may disappear.

Snow's Black Muscat is the popular variety elsewhere, and is cropping well. With the exception of Darra, little grafting on to the resistant stocks is practised in the new areas.

Avocadoes.

The avocado shows great promise providing the market expands to absorb production. Redland Bay, Tamborine Mountain, and Sunnybank are the chief sources of supply and a number of young orchards are located in the Redlands districts. Propagation appears to be fairly difficult and nursery trees are expensive and supplies limited. There are a number of varieties, but the market shows a distinct preference for Fuerte, a pear shaped fruit commencing to harvest about April and picking for about three months. Nabal and Anaheim may be added, however, to spread the harvesting period. Irrigation is an advantage in spring, as dry weather at setting causes heavy fruit fall.

Citrus.

Citrus growing has declined in importance over the last 20 years and there are very few orchards of any size except in the Redlands area, where lemons are mainly grown, and Tamborine Mountain. The latter district still produces a fair quantity of late fruit but many orchards are on soils which dry out quickly and cannot be irrigated. The Meyer lemon, an early cropping and drought-resistant variety, has been planted in the Redlands area, and the results are promising.

Tomatoes.

A suitable climate, a wide choice of varieties, a ready local market, together with a large interstate outlet, make this crop one of the most important in the district. At one stage during the recent war tomatoes were worth more to Queensland than any other horticultural crop and the metropolitan areas produced 40 per cent. of the total production.

Tomatoes are grown in all parts of the district at certain times of the year, production commencing in April and continuing to December. The main producing centres are the Bay islands, Redland Bay to

Manly, Sunnybank and Rochedale. Owing to the difficulties experienced with setting, the winter crop planted from April to June is trellised or staked and a preference is shown for the small but prolific cluster types such as Salads Special and Potentate. The most popular varieties, grown mainly as bush types in autumn and spring, are Grosse Lisse, Sioux, Rutgers and Red Cloud. All bear large fruit on vigorous plants. Diseases are sometimes prevalent during the warm and usually wet months of early autumn, and of these target spot and bacterial spot are the most troublesome. The corn ear worm used to cause serious losses in the autumn and spring crops but the use of DDT has given satisfactory control.

Vegetables.

Vegetable growing under irrigation comprises the main horticultural activity of all but a few of the districts. Cabbages and cauliflowers are grown extensively, the former in the Redlands area and the latter mainly at Pinkenba, Nudgee, Kallangur and Tamborine Mountain. By using DDT for pest control and planting the right varieties, cabbages can be grown throughout practically the whole year. The drumhead cabbages such as Succession were popular until recently, but market preference is developing for the round head varieties, such as Midseason Market and Copenhagen Market. The latter are smaller than the Succession, a larger number of plants are cropped to the acre, and they mature more quickly. The cauliflower season is limited, the crop

Plate 9.

Irrigated Vegetable Crops.—French beans in left foreground, cauliflowers in centre and staked tomatoes in right background. Note Skinner system spray lines.

being harvested from April to October on the coast. Tamborine Mountain has a longer season and planting commences earlier than in the coastal areas. There is still some uncertainty as to the best varieties for early planting, but Snowball, Phenomenal Early and White Queen have done well The later varieties have been mainly of the Phenomenal selections. "Whiptail" has been a serious trouble to cauliflower growers in all the main districts, and the use of ammonium molybdate to correct the disorder is now general (Plate 9).

Root crop production is a major activity in the Wellington Point, Birkdale, Sunnybank, and Sandgate areas and the city market gardens. Planting commences in early autumn and continues to June or July in the case of carrots and parsnips, and even later with beetroot. The early plantings are fairly risky but when successful are profitable. Formerly a rather costly crop to grow, carrots are now more easily handled since the introduction of power kerosene as a selective weedicide. The main variety is Red Cored Chantenay.

Beetroot are produced practically all the year round, with Early Wonder and Derwent Globe the most popular varieties. Lack of boron may cause serious losses with beetroot, but a soil application of borax prior to planting or at the first topdressing overcomes the trouble Parsnips are a small crop with a limited market demand. Most of the root crops are marketed locally in bunches of a dozen, but they are bagged if sent to other markets.

The cucurbit crops, which include cucumbers, melons and pumpkins, are grown in reasonably large quantities. Wellington Point and the Bay islands specialise in early cucumbers, the crop being harvested during September and October. Pinkenba, Nudgee, Kallangur and Redcliffe supply most of the melon and pumpkin crop. The main varieties of cucumbers are Kirbys Stay Green and Early Fortune, while Hawkesbury Wilt Resistant, Sweetheart, Kleckley Sweet and Klondyke are popular melons.

Lettuce is a favourite crop at Eight Mile Plains, Oxley, Nudgee, Manly and in the city market gardens. Production is not difficult in winter, but although the summer crop suffers from heat and mildews, it is considered the more profitable. A reliable summer lettuce is needed, but until such time as better varieties are found, Imperial 847 and Great Lakes will continue to be used. Imperial 615 is widely grown in winter crops planted from March to August.

Beans are planted in the South Metropolitan area throughout the year, now that bean fly can be effectively controlled with DDT. Summer production is difficult and results may not be worth the effort and expense. Early autumn plantings are also a gamble, as heavy rains affect this crop. Brown Beauty and Hawkesbury Wonder varieties do well; the former is the more widely planted.

THE FUTURE.

The future of a district usually depends on its market outlets, its capacity to expand, or its ability to at least hold its own against the competition of a newer source of supply. The first of these does not present any great problem for the types of crop produced in the metropolitan district, as they find a ready outlet in Brisbane and other markets. The expected drop in the demand for vegetables in the postwar period did not materialise and prospects of any major slump are

not evident at present. To the competent and experienced farmer, the post-war years have been generous. However, there are many new growers working comparatively poor country in the district. As vegetable growing is a highly specialised business, many of them will suffer setbacks until they limit their cropping programme to those crops for which the country is suited and can install a reliable irrigation system.

Any expansion in plantation and orchard crops would involve big acreages before any appreciable difference in the volume of production could occur. However, suitable new land is not available, but an increase in the area under pineapples, papaws and custard apples may take place at the expense of bananas. There is still a fair amount of new land available for pineapple production, but it is not up to the standard of that already under this crop. Papaws require much better conditions than pines, and any extension of this crop is improbable until better control measures for diseases are available. Strawberries are definitely a crop with a future, for production at present is limited mainly by lack of labour.

Few properties specialising in vegetables are working the available ground to its capacity, and greater production should be fairly easy under irrigation. Although it is expensive, most growers are in a position to extend their equipment, and it would be safe to assume that vegetable production could be doubled on the present acreage if the available markets needed the produce.

Should the Brisbane water supply ever reach the rich alluvial country of Pinkenba, Myrtletown and Lower Nudgee in sufficient quantity to allow of irrigation, large quantities of vegetables and certain fruits could be grown. It is a pity that such a potentially valuable horticultural area close to Brisbane should be worked well below its capacity.

CERTIFIED TOMATO SEED—1950.

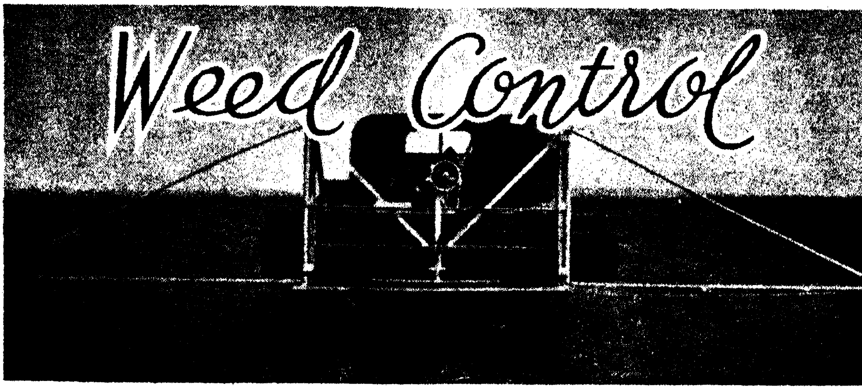
Under *The Seeds Acts*, 1937 *to* 1941, selected varieties of tomato were approved for certification during the 1949-1950 season. Certified crops were produced by the following growers, to whom enquiries for seed may be addressed:—

Grower.	Address.	Variety.
E. F. Wain	Bapaume	Q1
Harslett Bros.	Amiens	Q2
C. Couchman	Glen Aplin	Q3

Q1 is an early variety with Sioux characteristics.

Q2 is a mid-season variety with Grosse Lisse characteristics.

Q3 is a late variety with Valiant characteristics.



Chemical Control of Lantana.

B. EASTERBROOK, Assistant to Weeds Officer.

IN previous years, arsenic has been used with success to kill the roots of lantana by swabbing the cut-off butts or by spraying regrowth after brushing. However, hormone weedkillers have now been found to be effective and as they are non-poisonous to animals and humans, non-corrosive and do not kill grasses, they are to be preferred to arsenic in all circumstances.

Experience up to the present suggests that if Methoxone or the sodium salts of 2,4-D are used, consistently good kills can be obtained only if all old plants are brushed and sprayed some weeks later when there is an abundant and vigorous regrowth. If the regrowth is sprayed when very young, the roots may not be killed, as at this stage there is little downward movement of hormones within the plant. Therefore the best time to spray is when there is an abundant, leafy regrowth which is still actively growing. All the leaves and stems should be well covered with the spray. Small patches of regrowth are likely to occur, but these can be easily dealt with by later spot spraying.

If salts such as Hormex, Weedall, United and Weedar, or esters such as Weedone, are used, regrowth is likely to occur less frequently. 2,4,5-T formulations (either 2,4,5-T alone or in combination with 2,4-D) give better kills than 2,4-D alone, particularly on large bushes. Hence, if 2,4,5-T is used less brushing has to be done. However, it is usually not possible to spray effectively large areas of very dense, tall lantana because of the difficulty of getting through such country, so that brushing or burning of the lantana and spraying the regrowth will generally have to be done irrespective of whether Methoxone, 2,4-D or 2,4,5-T is used. In addition, 2,4,5-T is much dearer than Methoxone and the sodium and amine salts of 2,4-D, so that the use of the latter hormones, even with later re-spraying of small amounts of regrowth, is probably more economical than the use of 2,4,5-T.

The price of 2,4-D works out at roughly 22s. per pound of active constituent for all the brands except the ester Weedone, which costs about 32s. per pound. 2,4,5-T alone costs roughly double this, while 2,4,5-T in combination with 2,4-D costs about £1 12s. per pound of active constituent.

Hormones should be applied in fine, warm weather; rain falling within a few hours is likely to lessen greatly the effectiveness of the spray, although the oil-based esters are less likely to be affected in this way.

For small patches or in very hilly country where vehicles cannot go, knapsack sprays can be used. Their chief disadvantage is the fact that their capacity is about 3½ gallons, and therefore in high volume spraying, as is the case with lantana, much refilling is necessary. In suitable country, power sprays are very useful for spraying lantana. These sprays can usually be fitted with one or two hoses which are manipulated by men walking behind the vehicle on which the spray is mounted. Each hose should be fitted with one or two nozzles, preferably of the type which delivers a solid cone-shaped spray. The pump should be capable of developing pressures up to about 300 lb. per square inch. Outfits of this type at present cost in the neighbourhood of £80-£100.

Hormones must be thoroughly cleaned from equipment before it is used for any other purpose. All parts of the equipment should be washed about three times in warm, soapy water, then left to soak overnight in water to which household ammonia has been added at the rate of one quart to 25 gallons of water. Then rinse out thoroughly in cold water the following day. If esters are used, the equipment should be first rinsed in kerosene, then washed out as above.

Low volume spraying, applying 10 gallons or less per acre of a much more concentrated solution, has not been tested on lantana in Queensland, but it is not likely that this kind of treatment would be successful on a weed such as lantana.

No "Marker" for Weedicides.

Much time, labour and money is spent in the destruction or control of weeds by spraying with plant poisons or with hormones. It has been suggested that if the liquid used could be dyed with a suitable cheap "marker," then the path of spraying could be easily discerned, "overlapping" avoided, and a saving of both spray and labour effected, particularly on steep, rough or otherwise difficult country.

Following this suggestion, a number of dyes were tried in small tests in the Department's Chemical Laboratory. Blue, red and yellow household dyes, methylene blue, and potassium permanganate were all tried at various concentrations in an arsenical spray of normal strength.

The only one of these which left an easily discernible trail was methylene blue, but then only when used in such concentration that the cost would be high; indeed, greater than the cost of the arsenical spray itself.

The conclusion was reached that there is at present no readily available cheap dyestuff which could be used successfully as a "marker" for weedkillers. Suspended powders were not tested.

Report on Grade Herd Recording.

S. E. PEGG, Senior Adviser, Herd Recording.

THE Group Herd Production Recording Scheme for dairy cattle was introduced in Queensland in January, 1948, when the first unit was commenced at Beaudesert. This scheme appears to have filled a long-felt want, as applications for the formation of units have been received from many parts of the State.

Thirty-three units were operating during 1948-49, and this number could be greatly expanded if the necessary equipment were available.

This first report has taken into account all completed lactations since the inception of the units until September 30, 1949. Results have been compiled for 25 units, as the remaining 8 units have not been in operation long enough to have cows with completed lactation periods. In compiling the average production, only the first 270 days of any lactation is included.

TABLE 1.

NUMBER OF COWS AND THEIR AVERAGE PRODUCTION ACCORDING TO AGE GROUPS.

Age Group.	Number of Cows.	Milk.	Average Butterfat Test.	Butterfat.
(Years).		Lb.	Per cent.	Lb.
2	1,013	3,016	4·5	136
3	1,024	3,162	4·4	140
4	952	3,279	4·5	148
Mature	3,388	3,668	4·3	160
Unknown	10,839	3,208	4·3	139
Total	17,216	3,289	4·3	144

Table 1 gives the number of cows and their average production according to age groups. The average productions have been computed from 17,216 completed lactations from 507 herds. All completed lactations up to 270 days have been included, irrespective of the length of the lactation; in some cases cows dried off after 30 to 60 days in milk.

Table 2 shows the average production of cows in each herd recording unit. It will be seen that the highest average production per cow is to be found on the Darling Downs, where four units—Warwick, Allora, Oakey No. 1 and Oakey No. 2—showed averages of 190, 185, 184 and 185 lb. of butterfat respectively.

TABLE 2.

AVERAGE PRODUCTION FOR EACH UNIT.

Unit.	Number of Herds.	Number of Cows.	Milk.	Test.	Fat.
			Lb.	Per cent.	Lb.
Beaudesert	23	1,207	2,959	4·3	129
Maleny No. 1	20	944	3,110	5·0	155
Maleny No. 2	20	1,049	3,068	4·7	145
Oakey No. 1	24	725	4,185	4·4	184
Oakey No. 2	22	808	4,392	4·2	186
Oakey No. 3	16	121	3,536	4·2	149
Kingaroy No. 1	20	684	3,575	4·2	150
Kingaroy No. 2	19	506	3,042	3·9	120
Cooroy No. 1	22	772	2,757	4·4	121
Cooroy No. 2	22	596	2,299	4·4	102
Cedar Pocket	23	697	2,875	4·6	132
Pomona	18	634	2,685	4·4	118
Miva–Theebine	18	878	2,259	4·5	102
Goomeri	19	747	2,929	4·1	121
Allora	22	578	4,243	4·4	185
Warwick	19	670	4,774	4·0	190
Killarney	20	864	3,679	4·4	161
Monto	21	785	3,800	4·2	160
Toowoomba No. 1 ..	25	538	3,309	4·6	154
Toowoomba No. 2 ..	18	563	3,434	4·3	148
Toogoolawah	16	554	2,940	4·0	119
Kilcoy	19	587	2,583	4·4	113
Kenilworth	18	767	3,095	4·2	131
Malanda	22	606	3,829	4·3	163
Millaa Millaa	21	336	3,438	4·4	153

District Differences.

Much interesting information on the productive levels of herds in the different dairying districts of the State is provided by the results available to date. The average production of cows in herd recording groups in the districts was as shown in Table 3.

TABLE 3.

AVERAGE PRODUCTION PER COW.

District.	Average Milk.	Average Test.	Average Butterfat.
	Lb.	Per cent.	Lb.
Darling Downs	4,018	4·3	173
Southern Coastal Area (Gympie to N.S.W. Border)	2,822	4·5	128
Brisbane Valley	2,756	4·2	116
South Burnett	3,187	4·1	131
Upper Burnett	3,799	4·2	160
Atherton Tableland	3,690	4·3	160

Herd Differences.

The above figures show the effect of environment and farming practices in various districts on the productive standard of dairy herds. Within districts there were, however, appreciable differences in the average production levels of individual herds. The highest and lowest producing herds in each district were as shown in Table 4.

The desirability of raising the productive level of below-average herds is clearly evident from the above results. Comparing the average production of the lowest and highest herds in the southern coastal district, it will be seen that the monetary return per cow at the present

TABLE 4.

RANGE OF PRODUCTION.

District.	Highest Herd.			Lowest Herd.		
	Average Milk.	Test.	Average Fat.	Average Milk.	Test.	Average Fat.
	Lb.	Per cent.	Lb.	Lb.	Per cent.	Lb.
Darling Downs ..	7,690	4·1	320	2,295	4·2	95
Southern Coastal Area	5,471	5·0	273	1,512	4·3	65
Brisbane Valley ..	4,299	3·8	163	2,107	3·7	79
South Burnett ..	6,530	4·0	260	1,619	4·7	77
Upper Burnett ..	5,800	4·1	236	2,336	4·6	108
Atherton Tableland ..	6,898	3·9	274	2,143	5·1	109

price of 2s. 4½d. per lb. commercial butter was £39 10s. in the highest producing herd and £9 7s. in the lowest producing herd. Thus each cow in the best herd returned £30 3s. for the year more to its owner than the cows in the lowest producing herd.

TABLE 5.

NUMBER AND PERCENTAGE OF COWS GROUPED ACCORDING TO BUTTERFAT RANGE.

Age Group.		Under 50 lb.	50 to 99 lb.	100 to 149 lb.	150 to 199 lb.	200 to 249 lb.
(Years).						
2	No.	56	208	362	256	98
	%	5·53	20·53	35·74	25·27	9·67
3	No.	35	215	396	218	104
	%	3·42	21·0	38·67	21·29	10·16
4	No.	28	177	329	257	94
	%	2;94	18·59	34·56	26·99	9·87
Mature ..	No.	84	513	1,028	954	486
	%	2·48	15·14	30·43	28·1	14·34
Unknown ..	No.	570	2,280	3,752	2,623	1,086
	%	5·3	21·03	34·61	24·20	10·02
Total ..	No.	773	3,393	5,867	4,308	1,868
	%	4·49	19·71	34·08	25·02	10·85

Age Group.		250 to 299 lb.	300 to 349 lb.	350 to 399 lb.	400 to 449 lb.	over 450 lb.
(Years).						
2	No.	25	6	2	..	..
	%	2·47	·59	·2	..	..
3	No.	47	9	..	..	..
	%	4·59	·88	..	..	..
4	No.	46	16	4	..	1
	%	4·83	1·68	·42	..	·1
Mature ..	No.	207	72	34	9	1
	%	6·11	2·09	1·0	·26	0·3
Unknown ..	No.	385	108	28	5	2
	%	3·55	1·0	·26	·05	·02
Total ..	No.	710	211	68	14	4
	%	4·12	1·23	·39	·08	0·02

Age Groups.

Table 5 gives the percentage of cows in age groups in various butterfat production ranges.

Need for Pasture Improvement.

It will be noted from Table 5 that 4.49 per cent. of all the cows produced less than 50 lb. butterfat and a further 19.71 per cent. between 50 and 99 lb. butterfat. Farmers in most cases have already culled many of these low producers and it is expected that the herd averages of most members of units will show an increase in the coming years. On overstocked farms where pastures are solely relied on for the feeding of the herd, a reduction in the number of cattle, by making more fodder available for the remaining cows, should result in increased production.

The fact that the average production in Queensland for the year was 144 lb. butterfat and that only 16.69 per cent. of the cows produced over 200 lb. of butterfat should cause considerable thought to those engaged in the dairying industry. As the dairy herds in this State are mostly pasture fed, the condition both quantitively and qualitatively of the pastures on dairy farms is the greatest single factor affecting the production of milk and butterfat. No cow can be expected to produce well unless she receives an adequate supply of suitable food. It seems obvious that the first approach to the raising of the average productivity of dairy cattle in Queensland must be by way of better pastures and better pasture management. This problem calls for concerted action by all associated with dairy farming. The advisory services of the Department are available to all farmers who desire to improve their pasture and farming methods.

Herd Averages.

When the recorded herds are grouped according to their average yield of butterfat (Table 6), it will be noted that 14 per cent. of the herds had an average production of under 100 lb. butterfat, whilst only 11 per cent. gave an average of 200 lb. or more butterfat.

TABLE 6.

NUMBER OF HERDS IN VARIOUS BUTTERFAT PRODUCTION RANGES.

—	Under 100 lb.	100–149 lb.	150–199 lb.	200–249 lb.	250–299 lb.	Over 300 lb.
No. of herds, 507 ..	71	228	152	38	17	1
Percentage ..	14·0	45·0	30·0	7·5	3·3	0·2

Value of Recording.

Apart from the value of production recording to the individual farmer in the general management of his own farm, a herd recording scheme enables information to be collated which is of great help to the economy of dairy farming generally, and in defining problems for investigation. Information which should be of fundamental importance to dairy farming economy in Queensland is now being prepared from data already available from the scheme. In this connection the following matters are being investigated and the information obtained will be published in future issues of this Journal:—

(a) The effect of the month of calving on the production of milk and butterfat.

(*b*) The effect of the month of calving on the length of lactation.
(*c*) The average length of lactation.
(*d*) The effect of the length of lactation on production.
(*e*) The effect of test on the production of milk and butterfat.

Many farmers have ceased recording after one year, not realising the value of continuous recording. Farmers who cease recording after 12 months lose valuable information. At that stage they are just beginning to reap the benefit of the work, as many cows will not have completed a full lactation period and reliable records will not even be available for all cows in the herd.

The first year of recording indicates to the farmer the productive level of his herd and his standard of husbandry.

The second year enables him to cull his herd to the best advantage and plan his breeding programme.

The third and fourth years enable him to build the herd and improve his methods and the fifth year enables him to prove the value of the sire and thus of his breeding programme.

Continuous recording is also necessary to ascertain which families have the desirable qualities sought for in dairy cattle—high production, a long working life, regular calvings and resistance to disease—and so allow the farmer to concentrate on such families in his herd improvement programme. It is also regrettable that many farmers have been unable to give the ages of their cows. It is to be hoped that with the formation of herd recording units farmers will be encouraged to keep better farm records. A calf identification scheme has been drafted and will be introduced shortly. This will assist in the better identification of animals and will also ensure accurate information regarding age.

The Cooling and Holding of Milk and Cream on the Farm.

F. G. FEW, Dairy Technologist.

(*Continued from page 359 of the June issue.*)

CHARCOAL COOLERS.

THIS unit is designed for the storage of filled cans during the daytime. Therefore, its use is necessary only in the case of cream-producing farms on which farm refrigerators are not installed. The cream, cooled initially to the existing wet-bulb temperature by the tower re-circulation water system, must be held at the lowest possible temperature whilst awaiting despatch to the factory. Again, the wet-bulb temperature is the lowest storage temperature attainable, using only natural means of cooling, and the charcoal unit enables this temperature to be maintained for the necessary storage period. It must be emphasised that the cream is not intended to be cooled in a charcoal cooler, tests having shown that such is entirely impracticable. The cream, already cooled to the existing wet-bulb temperature at the time of milking, can, however, be maintained at that temperature by storing the cans in the cabinet of these units.

Design and Construction.

The practical construction of charcoal coolers is obviously an item of the greatest importance from the farmer's viewpoint. When these units were first investigated some years ago, considerable attention was given to existing types of coolers with a view to standardising a design incorporating all desirable features. Quite a reasonable degree of flexibility does exist, however, especially in regard to the choice of suitable building materials, and this may considerably simplify the actual construction on the farm. The drawings included (Plates 10-14) have been made to facilitate the construction of a cooler unit, and they include features considered necessary as a result of the investigational work. Brief specifications of possible materials of construction are also included, all of which are equally suitable for the specific purpose mentioned.

Construction.

Foundation and floor of cabinet: concrete.

Sides of cabinet and cooler unit: chain wire or wire-netting.

Back of unit: concrete, fibro-cement, timber or galvanised iron.

Front of unit: hardwood, fibro-cement, or galvanised iron. Door, 1 inch hardwood, packed with charcoal.

Cabinet back and roof: galvanised iron soldered at joins or lightly reinforced concrete.

Uprights, 2 inch by 2 inch hardwood. Hinges, 2 inch by $\frac{1}{8}$ inch M.S. Vent, 4-inch diameter galvanised piping 3 feet high.

Essential features in the construction are the inclusion of charcoal-packed sides, with additional charcoal insulation on the top and at the back of the inner chamber. A thickness of 10 inches is ample for maximum efficiency, although the thickness on top can be greater, especially if the top of the unit is left open and the unit is in an outside exposed position. This outside location is quite allowable and permits

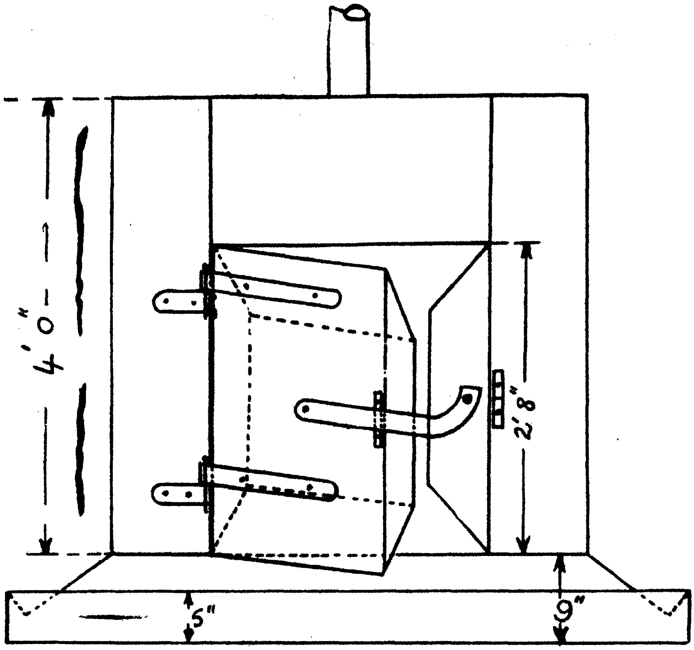


Plate 10.

Front Elevation of 4-gallon Can Size Charcoal Cooler.—The bevelled door is is 2 ft. 8 in. high by 2 ft. 4 in. wide outside.

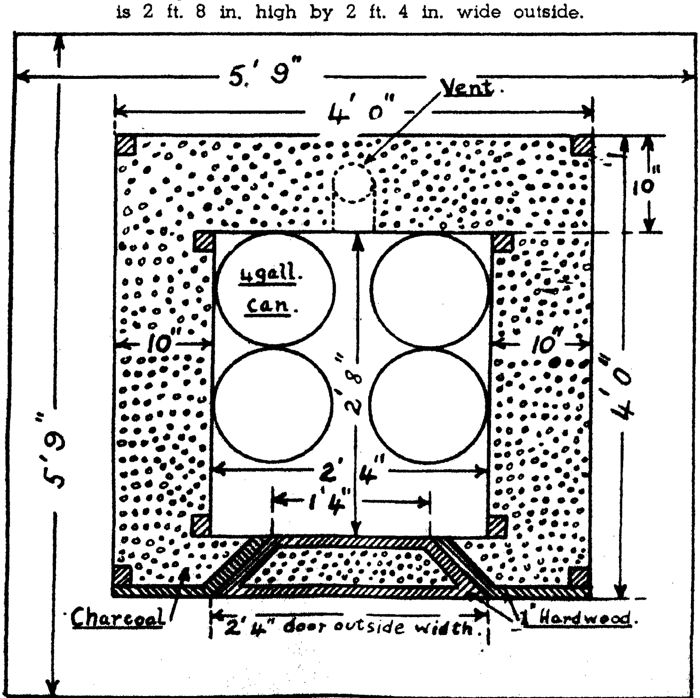


Plate 11.

Sectional Plan Through 4-gallon Can Size Charcoal Cooler.—The concrete base is shown. The bevelled door is 6 in. thick and has inside measurements of 1 ft. 6 in. high and 1 ft. 4 in. wide.

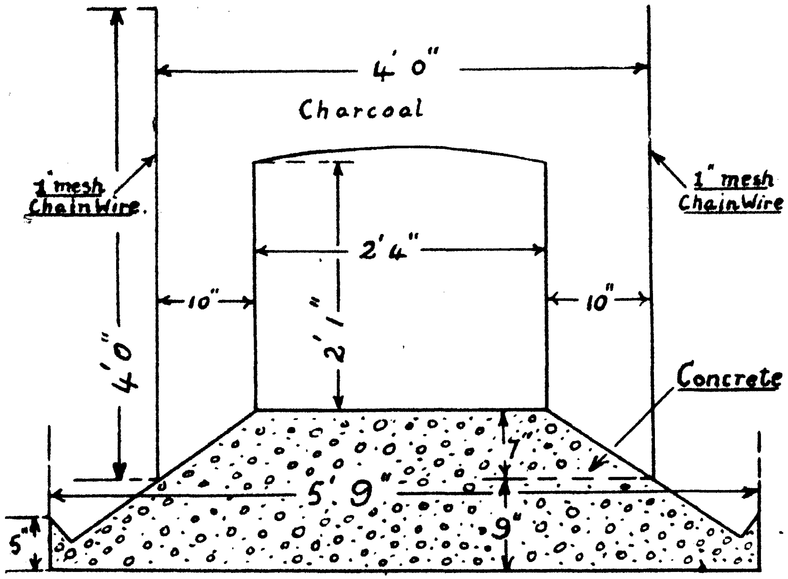


Plate 12.

Sectional Elevation Through 4-gallon Can Size Charcoal Cooler, Showing Open Top and Concrete Base.

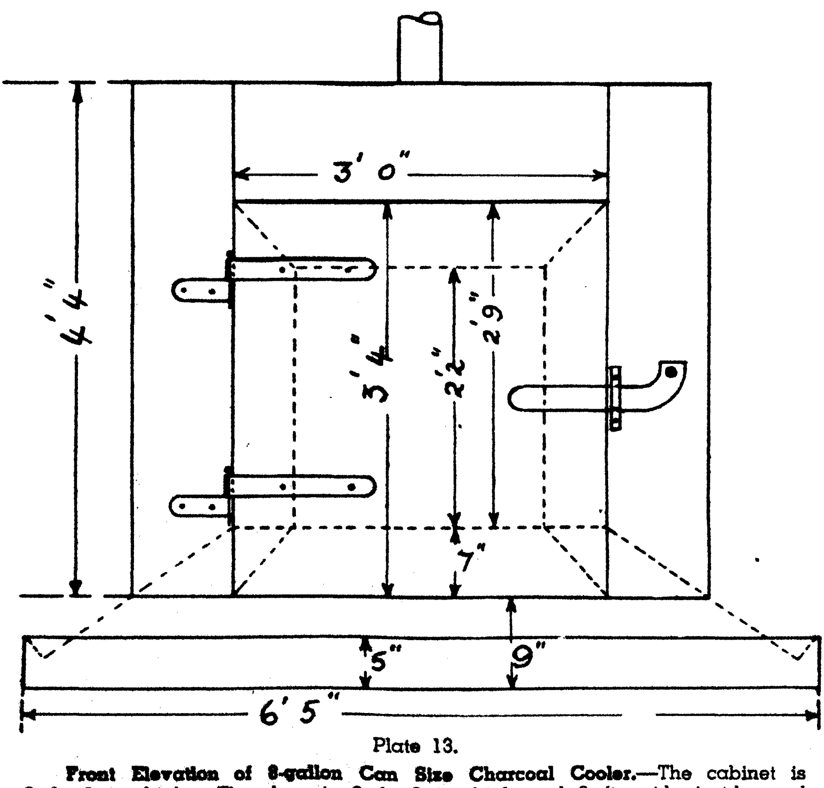


Plate 13.

Front Elevation of 8-gallon Can Size Charcoal Cooler.—The cabinet is 2 ft. 9 in. high. The door is 2 ft. 2 in. high and 2 ft. wide inside, and 3 ft. 4 in. high and 3 ft. wide outside.

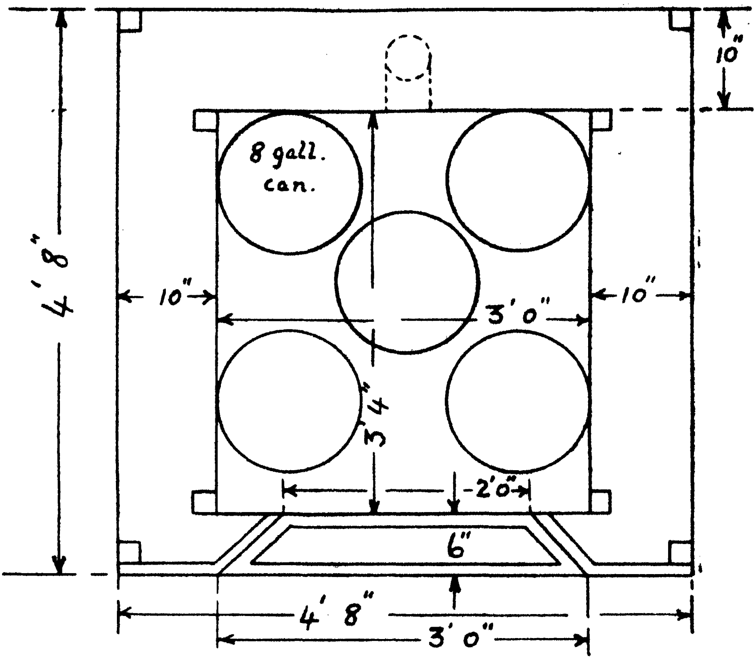


Plate 14.

Sectional Plan of 8-gallon Can Size Charcoal Cooler.

construction at a place often more convenient for one reason or another than the dairy building. The open top of the unit is shown in the sectional elevation (Plate 12), which is unshaded to allow inclusion of as many dimensions as possible. The charcoal itself is easily prepared from any suitable timber on the farm and should be reasonably small in size, well-packed, but definitely not powdered to any appreciable extent. The charcoal at the side of the unit, both inside and outside, is kept in place with chain wire (1-inch mesh), or, alternatively, half-inch wire netting, additionally supported with metal or wooden slats. With the exception of the sides and the short vent pipe, the inner cabinet is practically airtight, the vent being placed either at the top of the back wall or at the rear of the cabinet ceiling itself. A proper cold-storage type door is advisable to ensure air-tightness and effective insulation, the hollow interior of the door being most conveniently packed with charcoal. The inner cabinet can be constructed of a reasonably rust-proof material such as galvanised iron, although lightly reinforced concrete is also suitable. The roof is preferably arched to ensure the draining off of any water added to the top of the cooler, while the floor should be raised as shown to prevent water accumulating in the cabinet after watering the sides or top. All around the inner cabinet charcoal of a thickness suitable for insulating purposes, as well as allowing evaporative cooling in the case of the sides of the unit, is placed. It is also quite practicable to use a layer of charcoal beneath the concrete floor and foundation for insulation purposes, a thickness of 6 to 12 inches being ample. The concrete foundation includes a shallow trough which, when filled with water, effectively prevents ants from gaining access to the cooler chamber. Likewise, the vent pipe should be covered with coarse-mesh gauze at the end of the

uptake to avoid the entry of frogs, snakes, &c., while, in addition, a cowling can be fitted to prevent entry of water during periods of heavy rain.

The dimensions given are suitable for coolers of two sizes depending on the capacity of the cans to be stored. Two sizes, one suitable for 4 gallon cans and one for 8 gallon cans, are shown in the designs, and either should meet the requirements of average farms. Four of the smaller sized cans can be stored in the smaller cooler, while the larger unit is capable of holding five 8-gallon cans. It will be noted that the height of the inner cabinet in the case of the larger cooler has been made sufficient to allow inclusion of a shelf, the height of an 8 gallon can being only approximately 21½ inches. Quite a useful storage for certain household food articles can thus be provided, and there is no objection to this practice if proper care is taken with regard to the articles to be stored in the cooler.

Operation.

When investigations were made on charcoal coolers, attention was given to the most efficient method of operating the units. The following technique is recommended as a result of this work:—

One or more buckets of water are used to thoroughly wet the charcoal sides and top of the unit, this operation being preferably carried out as early as possible in the morning. After milking, the cans of cooled cream are placed in the cabinet and the door is securely closed. Generally speaking, no further addition of water should be necessary until the following morning, and, in any case, watering during the hot part of the day should be avoided. Under extremely dry conditions the application of water may be necessary more often, and, if so, an evening watering in addition to that usually practised in the morning can be given to the unit.

As a general rule it is inadvisable to open up the cabinet or remove the cans from the cooler overnight. The morning and evening, at which times the cabinet door will be opened to receive or remove cans of cream, should be used for thoroughly stirring all stored cream. Under average conditions, stirring the cream more frequently is not necessary if it has been shock-cooled initially to the existing wet-bulb temperature.

The interior of the cabinet should be kept in a clean condition; with the designs given, this is a matter of little difficulty. The cover suggested for the vent pipe and the raised floor of the cabinet assist materially in avoiding undue fouling of the storage section. Lids can also be safely left off cans during storage in properly constructed units.

Costs.

Apart from the fact that existing atmospheric conditions allow evaporative cooling to be quite practicable over a large part of the State, the relatively low cost involved in constructing and operating charcoal coolers is a big factor in their favour. All coolers seen on farms in the Wowan district—where many units are installed—during a visit in 1945 were made by the farmers themselves, and the complete cost varied from £8 to £15. Differences in size and materials of construction largely account for the variation in price, more particularly the latter.

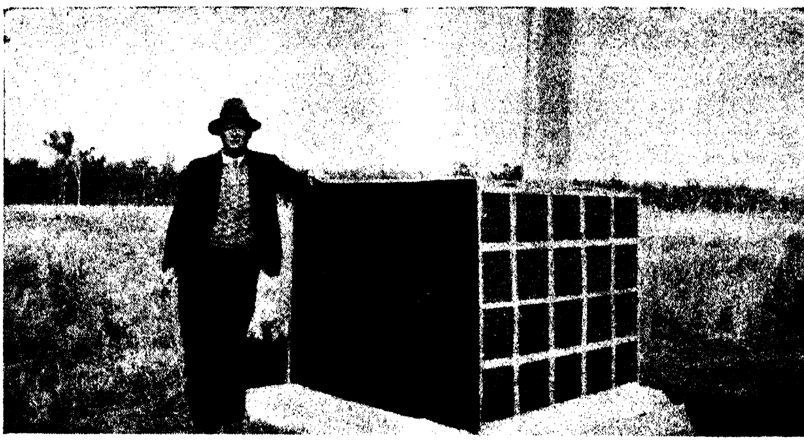


Plate 15.
Front and Side View of 4-gallon Can Size Charcoal Cooler.

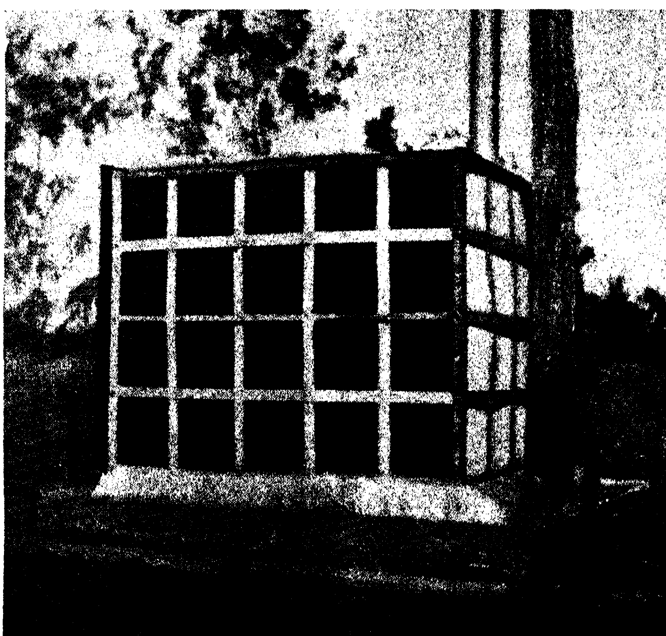


Plate 16.
Side and Back View of 4-gallon Can Size Charcoal Cooler.

Under present-day conditions it is not possible to give any accurate cost details; in any case these would be of little value owing to the wide variation in supply and cost of all building materials. It is, however, sufficient to state that for a relatively low cost any handyman can construct an efficient charcoal cooler quite effective for cream holding purposes in many dairying districts of the State. Plates 15 and 16 show the 4-gallon can size charcoal cooler used largely in the experimental

work carried out some years ago on these coolers. The one unnecessary feature is the long flue pipe (20 feet in this case) which can be reduced to one 2 or 3 feet length of piping.

COOLING STANDARDS.

As far as farm refrigerator units are concerned there is no necessity for checking cooling efficiency. Provided the units are functioning properly the degree of cooling listed in the text will be realised so long as the capacities stated are not exceeded. The necessity for fulfilling these requirements is the basis on which the units are designed.

The water-cooling tower system and the charcoal cooler are designed on the physical principles underlying natural evaporative cooling and will perform efficiently and satisfactorily if correctly operated. A provisional standard has, however, been made for testing these units in the field and it is of value in detecting any faults that may occur in either system. The technique recommended in the field is as follows:—

When the can is filled the milk or cream should be thoroughly stirred and the temperature taken, using a dairy thermometer. Readings of the existing wet-bulb temperature should be made at the beginning, middle interval and end of the milking period. More frequent readings can be taken if desired, but for a normal milking period between half an hour and 1½ hours the three stated will suffice. The temperature of each can of milk or cream should, however, be observed unless the number of cans is unusually high. Under average atmospheric conditions the wet-bulb readings will not vary by more than a few degrees and the same remarks apply generally to the milk and cream temperatures noted. As a result, the average wet-bulb temperature and the average reading for the milk or cream can be deduced by simple calculation. The cooling efficiency can be regarded as quite satisfactory if the milk or cream temperature does not exceed the wet-bulb temperature reading by more than 5° F. If a charcoal cooler is also to be tested the thermometer should be suspended inside the closed cabinet and left for some time. The door can then be opened and the temperature recorded as quickly as possible. The reading should not differ very much, if at all, from the wet-bulb temperature, and the 5° F. margin can be regarded as the maximum divergence allowable. A much closer agreement can be expected in all properly designed units.

Any farmer installing any of the equipment listed can have tests made to check efficiencies if so desired. The simplest way is to request such a test from the local visiting Dairy Officer, who will arrange accordingly. From results obtained it is generally possible to trace any faults that may have developed and their elimination will allow the farmer to receive the full benefit from the equipment he has been prepared to install.

SUMMARY.

The production of a good quality milk or cream depends materially on farm cooling facilities. The desired temperature is determined largely by the form of consumption intended for the product, but also to some extent by the holding time on the farm. The rate of cooling should, in general, be as great as possible but is influenced to some extent by the available time before despatch from the farm. Alternative

cooling systems are available when those considered most satisfactory are not favoured. The recommendations made in this article are summarised as follows:—

Market Milk.

(1) Farm refrigerator units used in conjunction with initial water cooling using the tower re-circulating system. The shock cooling system is employed in the case of the morning's milk whilst immersion cooling is used for the evening's milk to be kept overnight. The temperature after cooling should not be above 40° F. and must not be exceeded during any storage period.

(2) Water-cooling alone using recirculated water from a tower system. This system will generally ensure cooling to approximately 70° F. even under summer conditions. Market milk cannot, however, be safely stored at this temperature and this system is only applicable to milk despatched from the farm shortly after being produced.

Cheese Milk.

(1) It is obvious that farm refrigerator units can be used for the cooling of milk for cheese manufacture and, as far as the cooling problem is concerned, will prove equally as satisfactory as for market milk. The temperature, however, need not be so low and 50° F. is considered adequate both for cooling and for any subsequent storage. Tower recirculated water should be combined with refrigeration to effect running economy and ensure the maximum cooling capacity.

(2) Water-cooling alone using the tower system with overnight storage in a pit extension designed to accommodate the cans of evening milk. On the Downs—the State's chief cheese-producing area—very good cooling can be obtained because of suitable atmospheric conditions, and a temperature not exceeding 70° F., even under summer conditions, can almost invariably be reached for both the cooling and the storage of farm milk. Throughout most months of the year considerably lower temperatures can reasonably be expected.

Cream.

(1) Farm refrigerators alone with shock-cooling of the cream throughout the necessary cooling range in all cases. The desired temperature for both cooling and subsequent storage is 50° F.

(2) Without refrigeration the cream should be water cooled from a tower system using a surface tubular cooler. Subsequent storage, while awaiting despatch to the factory, should be provided by the use of a charcoal cooler.

Wool and Its Manufacture.

G. R. MOULE, Director of Sheep Husbandry.

THE diversity of woollen fabrics is sufficient evidence of the complexity of the woollen manufacturing industry. It is also indicative of the variation in the raw wool utilised in making different trade lines. These variations in staple length, fibre diameter, tensile strength, handle, colour and condition are apparent on examination of a number of lines offered for sale. The aim of classing is to sort the wool into uniform lines so that buyers can purchase the line of wool required for the manufacture of the type of fabric they wish to produce.

Differences in manufacturing methods dictate the classing, and an understanding of the processing of wool is the key to correct classing.

Woollen fabrics are classified as:—

(i.) Worsted, which is closely woven from tightly spun yarn and which has a smooth finish. Men's formal suitings are a good example.

(ii.) Woollen, which is less closely woven from more loosely spun yarn and which has a fluffy surface. Blankets, billiard table cloths, and Donegals are all woollens.

(iii.) Knit wear, which consists of threads knitted together and varies from half hose to wool jerseys.

(iv.) Felt, in which the woollen fibres are intertwined and matted. Fine felt is commonly used for the manufacture of hats and coarse felts for saddle blankets.

Scouring and Blending.

After the wool has been delivered to the manufacturer, it is scoured and blended. The scouring process (Plate 17) consists of washing the wool in warm soapy water to remove the dirt and yolk. It is carefully handled so that it will not "felt." Special treatments with dilute acids are sometimes required to remove grass seeds and burrs; this is referred to as carbonising, as the burrs are charred to carbon and removed with the liquid. Blending is the mixing of different wools to ensure the production of yarns of a particular type and the most economical usage of the available wool. Often these two processes are combined.

Plate 17.
Scouring Fleeces.

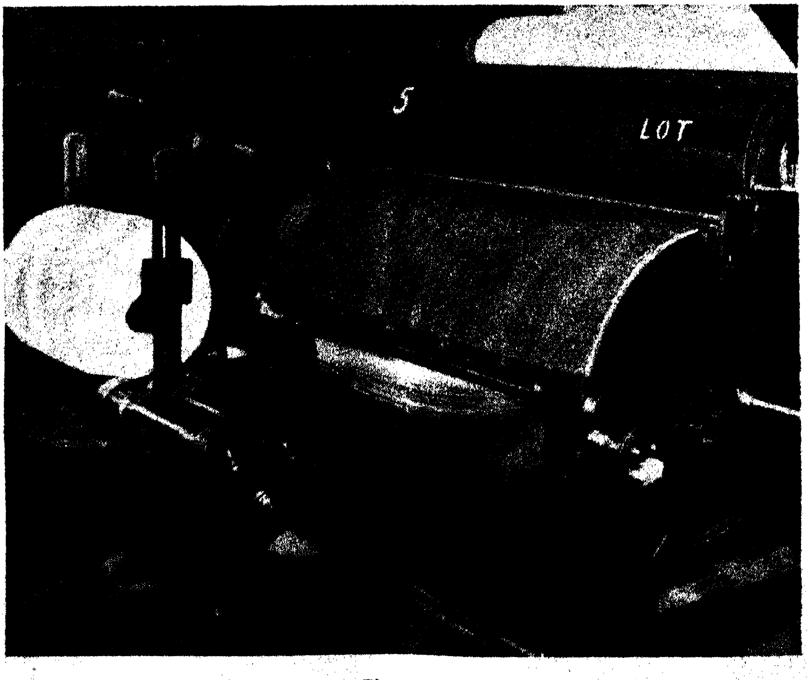


Plate 18.
Carding Machine.

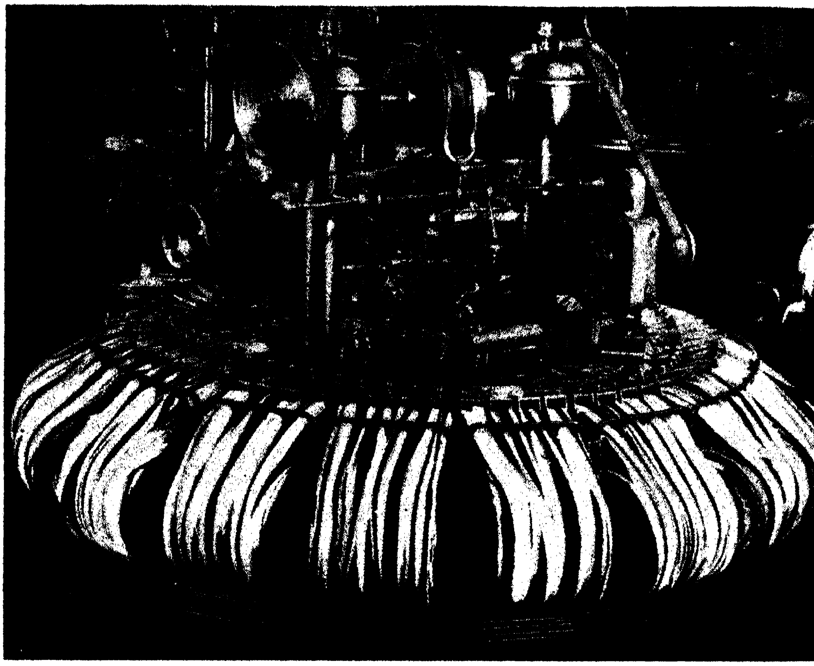


Plate 19.
English Combing Machine.

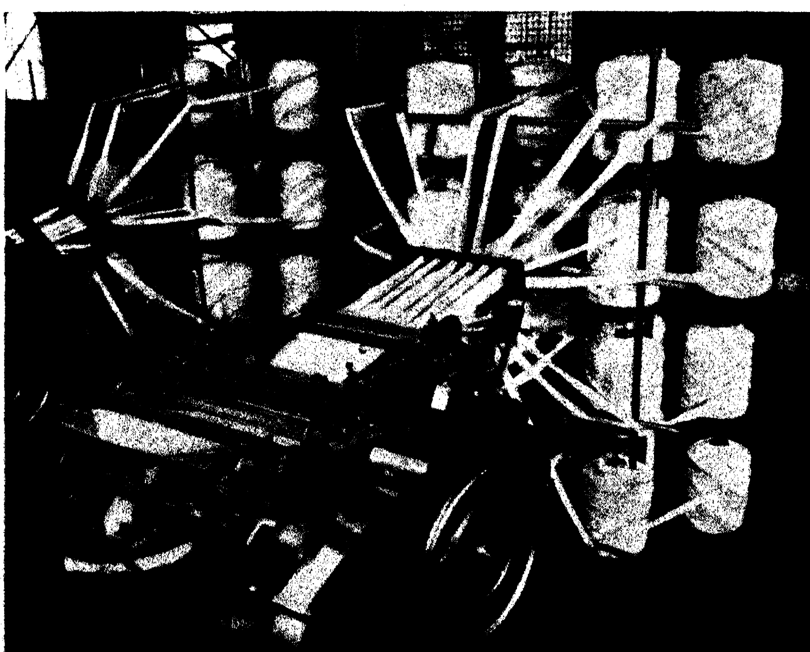


Plate 20.
French Combing Machine.

Carding.

The first important differentiation in the manufacturing process takes place after scouring. The shorter wools, used for the making of worsteds, woollens and knitwear, are sent to a carding machine (Plate 18). This consists of a number of drums which rotate at different speeds, and the fine wire teeth, with which they are covered, tear the wool apart and lay the longer fibres more or less parallel. The shorter fibres are left lying obliquely across the longer ones with which they interlock. The wool comes from the carding machine as a wide thin film and goes to a condensor which divides the film into a number of even strips. These strands are referred to as "slivers."

Plate 21.

Worsted and Woollen Yarns, Highly Magnified.

From The World Book of Wool.

Combing.

The longer wools used for worsted manufacture go through various processes of preparation for combing. Shorter wools, which are to be used for worsted making and which have been carded, are also combed. In this process the long fibres are all laid parallel and the shorter ones are removed.

These, together with any clusters of fibres and foreign matter, are termed noil. There are two main types of combing machines, the English comb (Plate 19) and the French comb (Plate 20). The latter can utilise shorter wools than the former. The wool as it leaves the combing machine is referred to as combed tops. These are then dyed, washed and reduced in size by drawing, prior to twisting or spinning them into threads.

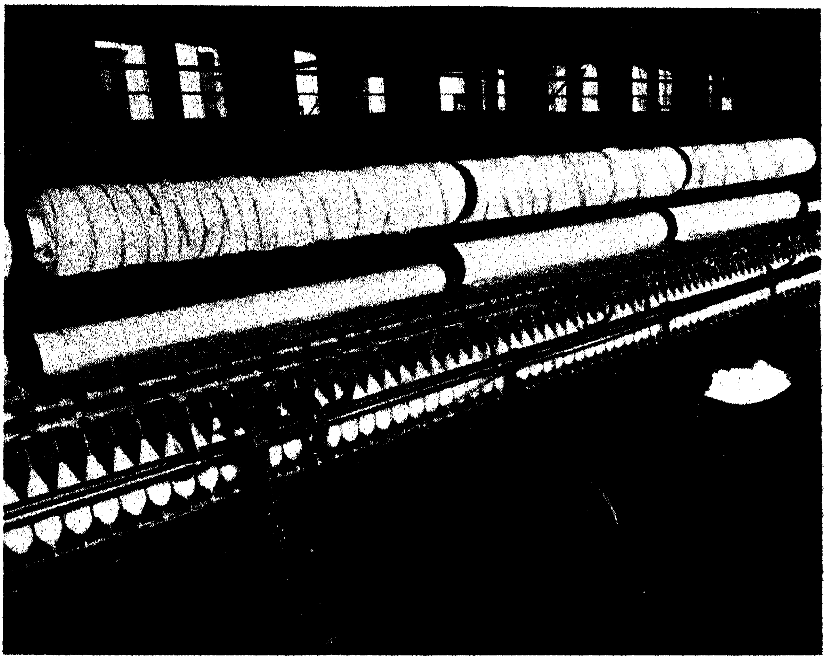


Plate 22.
Woollen Spinning.

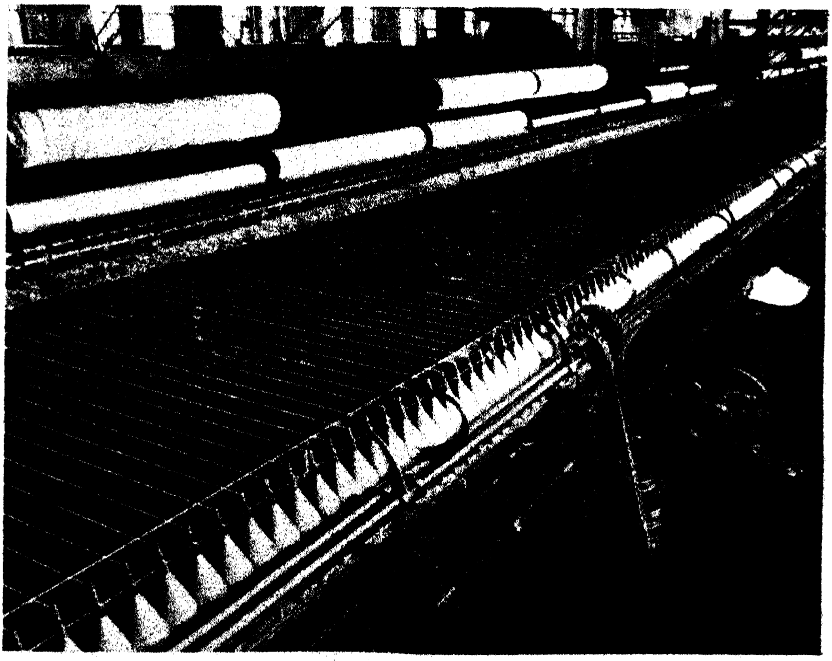


Plate 23.
Woollen (Mule) Spinning.

Spinning and Weaving.

Further differentiation in the manufacturing process occurs in the spinning. Worsted threads are tightly spun, and present a smooth appearance (Plate 21). They are round and even, strong and elastic. Woollen threads are loosely spun and because of the interlacing cross threads present a fluffy appearance. They are full and soft to handle. Spinning machines are shown in Plates 22 and 23.

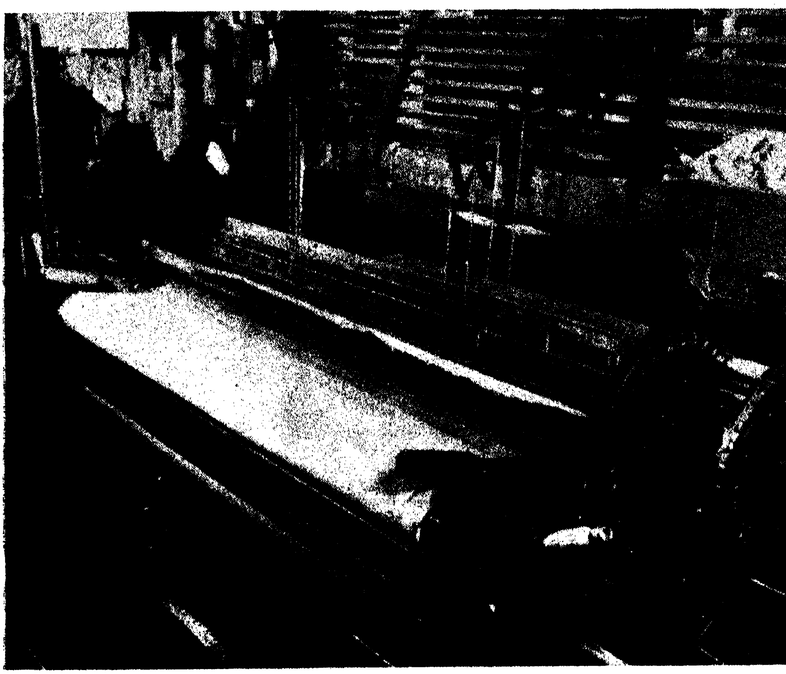


Plate 24.

Weaving Woollen Cloth.

The cloth is manufactured by weaving (Plate 24) or knitting. In the former process long threads known as "warp" (Plate 25) are selected to run lengthwise, while "weft" is the term applied to the threads which run across the fabric. The warp threads are moved up and down in the loom according to a prearranged plan and the weft threads are placed between them by the backward and forward movements of a shuttle. By varying the order in which the warp threads move up and down in relation to the movement of the shuttle a pattern can be woven into the fabric. Some cloths are dyed (Plate 26) after weaving, and worsteds pass over a roller and beneath a set of rotating blades (Plate 27) which "crop" any free fibres. Most cloths are examined for flaws and they are then pressed and rolled for sale (Plate 28).

The knitting industry can be divided into three main branches—hosiery, underwear, and outerwear manufacture. The processes in manufacture are similar, but there are wide variations in the size of the yarn used and the number of stitches per inch.

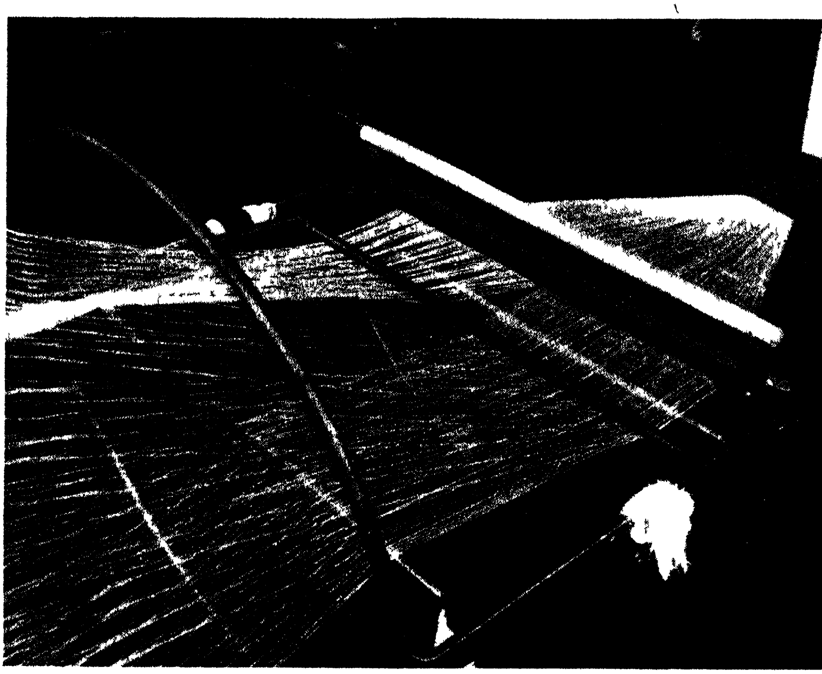


Plate 25
Close View of Warp Threads.

Plate 26
Dyeing Cloth.

Felt making is probably the oldest form of woollen manufacture, but more recent developments in this branch of the industry have greatly increased the variety of materials produced. Fine light felts are used for hat making. A heavier grade is used for the uppers of felt slippers and in furnishing and upholstery felts. The felts used for floor coverings are heavier still, while those for numnah pads in saddle making or as beds for heavy machinery are thick and spongy.

These different types of felt require wools of special quality and lines from certain districts are sought by buyers for felt making. After blending, the wool is carded, but instead of being divided into a number of even strips by a condensor, it is taken off in the form of a wad, which is placed in a hardening machine. Here it is subjected to pressure, heat, and friction, and the fibres become entangled. This process is continued by milling, during which the felt is shrunk still further. During this process the material may be shrunk by as much as 50 per cent. in its length and width. The felt is then washed and dyed, and stretched to the required standards. All protruding fibres are "cropped" from its surface and it is pressed and rolled ready for sale.

During the whole of the manufacturing processes the wool is oiled, to make it slip easily, and there is some interchange of material. For instance, the noil, which consists of short fibres removed by the combing machine, is worked into the carded wools for woollen manufacture. In this way waste is reduced. A considerable amount of pull is exerted on individual fibres and upon yarns and fabrics during manufacture. Tender wools—that is, those which have a weak spot in the length of their staple, may break under this strain. Accordingly they are not sought by buyers.

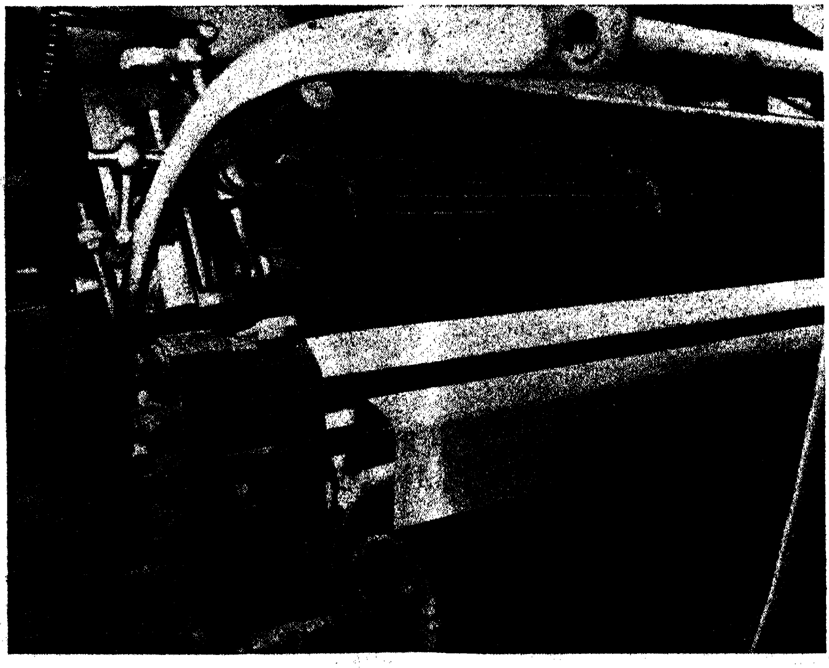


Plate 27.

Cropping Machine.

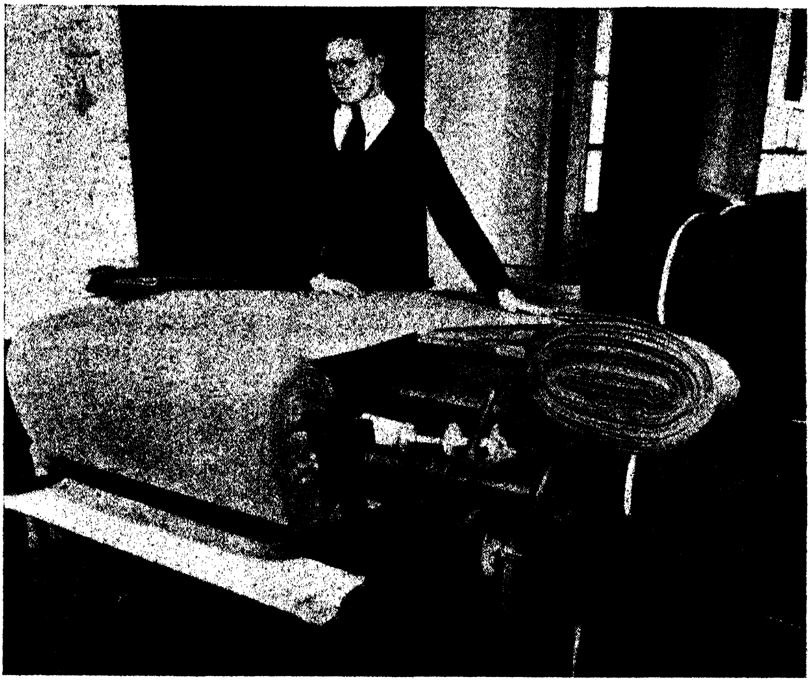


Plate 28.
Pressing and Rolling Cloth.

ACKNOWLEDGEMENT.

The illustrations in this article, except Plate 21, are from photographs of the Australian National Publicity Association, which has kindly permitted their reproduction.

JUNIOR FARMER NEWS.

Annual meetings of several Junior Farmer Clubs have resulted in some changes of secretaries, including Allora (Neville Gartner), Warwick (Colin C. Madsen) and Thangool (Ronald G. Reeve).

New clubs have been established recently at Eton North, Racecourse and Eungella in the Mackay district, and at Goovigen and Wowan in the Dawson Valley. The secretaries of these clubs are Messrs. J. Blackburn, Ken. Muller and S. M. Howie, and Misses T. Durken and P. Cue, respectively.

Three members of the British Junior Farmers' League recently spent a fortnight in Queensland visiting the Warwick, Murgon, Wondai, Gayndah, Biloela and Theodore districts. At each centre the lads were quartered at the homes of club members and were tendered civic receptions. They visited a number of well-known dairying, fruit-growing, pastoral and general farming properties during their stay and were also shown over butter, cheese and bacon factories.

A Rare Cystic Ovary.

Mr J. J. McLachlan, Northern Poultry Adviser, has supplied the accompanying illustration of an enormous cystic ovary in a hen. A cystic condition of the ovary in hens is only occasionally seen, and as a general rule there is very little increase in size. The bird shown here found it necessary to rest after walking a few yards. When walking, the body was carried at an angle of about 60 degrees, the legs being forced very wide apart and the abdomen almost touching the ground.

The weight of the carcase after removal of the cystic ovary was 3 lb. 15 oz. and the cystic ovary weighed 2 lb. 3 oz. The hen was in well fleshed condition and between two and three years of age.

Cystic Ovary in White Leghorn Hen.

Photo.—C. and T. Pinder, Ingham.

ANIMAL HEALTH

Coccidiosis of Poultry.

P. J. O'SULLIVAN, Parasitologist, and A. K. SUTHERLAND, Senior Veterinary Pathologist, Animal Health Station, Yeerongpilly.

COCCIDIOSIS is the name given to infections of the intestine caused by microscopic parasites known as coccidia. Wherever chickens are kept under artificial conditions coccidiosis is the greatest hazard in their successful rearing. The disease causes enormous economic loss through deaths and decreased egg production due to the poor development of many which survive an outbreak.

In the last few years treatment with sulphonamides has greatly reduced losses from coccidiosis and poultry farmers have spent large sums on these drugs. It is considered wiser, however, to prevent coccidiosis by management based on knowledge of the parasite and the disease rather than to rely on drugs to control outbreaks after they occur.

Coccidia occur in most domestic animals but each species is remarkably host specific. Thus the coccidia of fowls are unable to survive in any other host. Similarly the coccidia of turkeys, ducks, geese, and other birds and animals cannot infect fowls.

Several different species of coccidia infect the intestines of fowls. Their effects range from a mild catarrh of the intestine to severe disease with extensive inflammation and haemorrhage resulting in death.

Two species of coccidia are important in fowls. They are *Eimeria tenella,* which causes caecal coccidiosis, and *Eimeria necatrix,* the principal cause of intestinal coccidiosis. Several other less harmful species infect fowls but they cause disease only on odd occasions.

LIFE CYCLE OF COCCIDIA.

Infection follows the ingestion of a mature (or sporulated) coccidia "egg," known as an oocyst, with the food or water, or from the litter. The digestive juices of the bird release from the oocyst motile forms known as sporozoites, which invade the cells lining the intestine (Plate 29). These sporozoites grow bigger at the expense of the host cells and then divide into numerous small merozoites, which in turn invade other intestinal cells. This type of asexual reproduction goes on for two generations, then some of the merozoites develop into male and female forms which mate to produce the oocyst or "egg." The oocyst has a thick shell and is passed out of the host in the droppings (Plate 30). In the presence of warmth, moisture and oxygen, further development takes place, so that in 48 hours or longer the oocyst has matured or sporulated, *i.e.,* contains sporozoites, and is then capable of infecting a chicken.

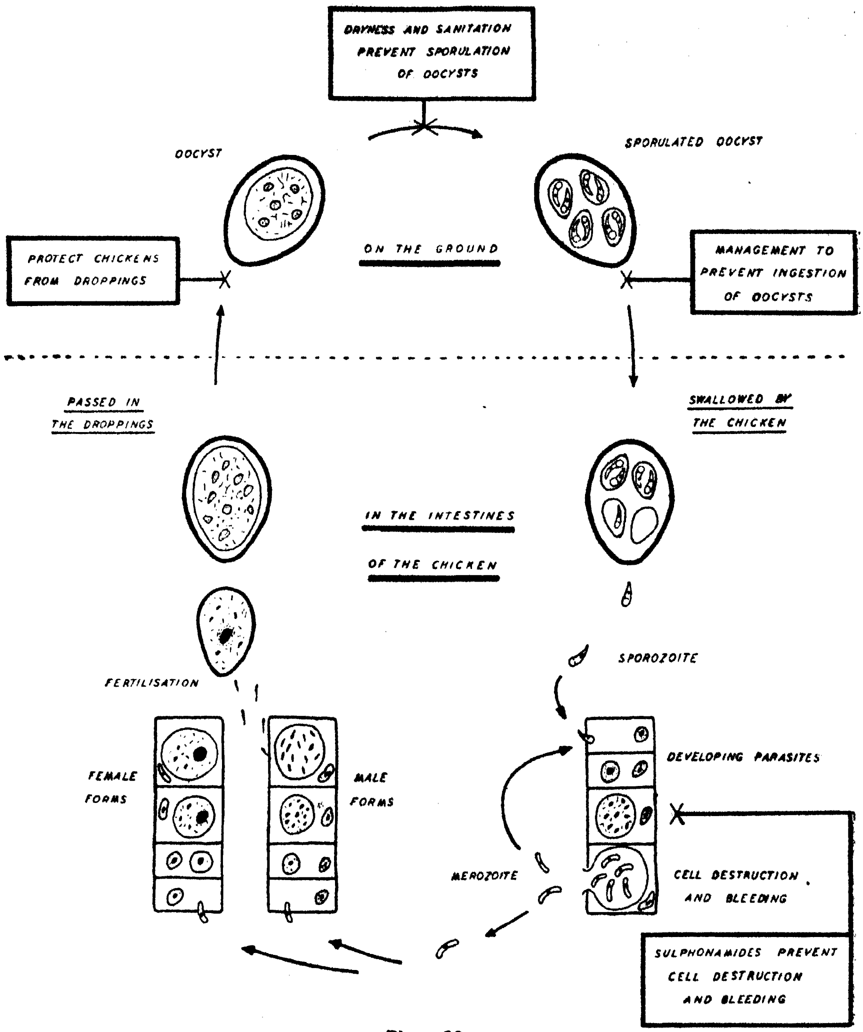


Plate 29.

Diagram of the Life Cycle of Poultry Coccidia.

The sporulated oocyst is very resistant and is capable of surviving in moist shady places for many months. Sunlight and dryness destroy the oocysts but they are very resistant to disinfectants.

The droppings of sick birds contain enormous numbers of oocysts. Chickens which appear healthy after recovery from coccidiosis may excrete smaller numbers of oocysts for many months. These oocysts are scattered in and about the litter and the feed and water troughs, from which they are picked up by susceptible fowls. Oocysts may be spread from pen to pen or from farm to farm on boots, buckets, crates, and other equipment.

CAECAL COCCIDIOSIS.

This is the commonest form of coccidiosis and is responsible for heavy losses. It occurs most often in chickens between 4 and 10 weeks of age but younger or older birds are occasionally affected.

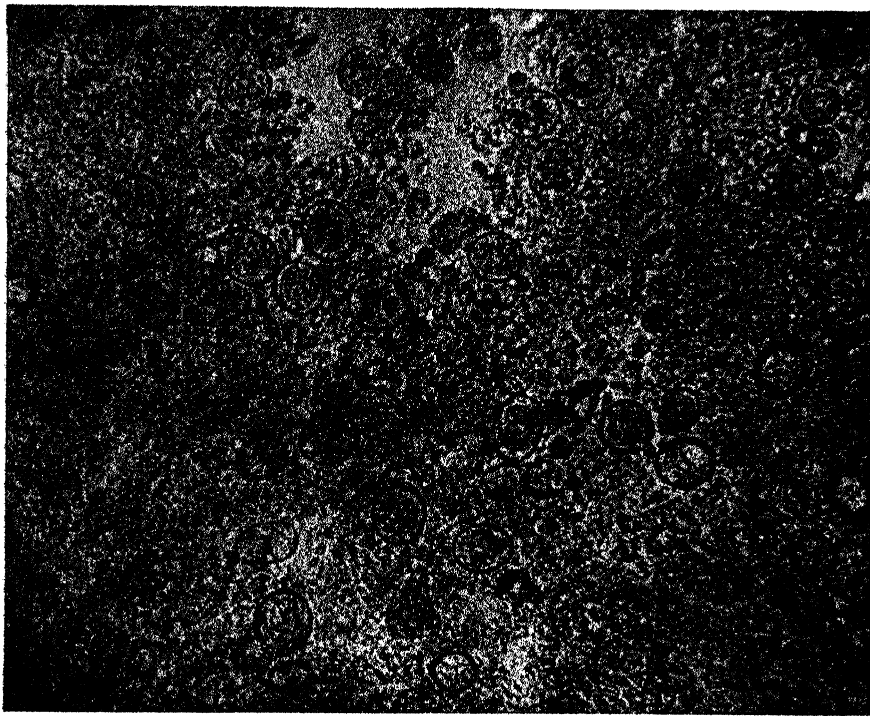


Plate 30.
Coccidia Oocysts in Intestine of a Chicken (magnified approximately 400 times).

Symptoms.

Severely affected birds appear depressed and huddle together with their feathers ruffled as though they were cold. The wings droop and the shanks and comb are pale. The thin watery droppings may contain blood, which often stains the tips of the wing and tail feathers. In some cases the droppings appear to be all blood. In less acute cases there is listlessness, paleness, and ruffled plumage, and the droppings may show a brownish tinge indicating the presence of blood. There is usually rapid loss of weight. The appetite is depressed. Water consumption is greatly increased in the early stages of the disease but is decreased during the acute stages and does not return to normal unless and until the birds start to recover.

Mortality as high as 60 per cent. occurs in severe natural outbreaks. The acute stage of the outbreak usually lasts one to two weeks but occasional deaths occur for several more weeks. In mild outbreaks deaths are spread over a longer period because only a few chickens pick up large doses of oocysts at any one time.

Chickens that have shown definite symptoms and have recovered from coccidiosis are generally stunted and more susceptible to other diseases and parasites. Often the effects are still noticed when the birds come into production.

Recovered chickens have a strong immunity to further attacks of caecal coccidiosis but they are still susceptible to the other forms of coccidiosis which affect the small intestine.

Post-mortem Findings.

In acute cases the lining of the caeca (blind guts) is extensively eroded (*i.e.*, ulcerated) and the caeca are filled with blood. In less acute cases the caecal wall is thickened and ulcerated and shows haemorrhagic patches (Plate 31). A cheesy core tinged with blood is often present, particularly in the later stages of the disease. In mild cases microscopic examination may be necessary to detect the disease. An accurate diagnosis should be made quickly so that treatment can be started before the whole batch is seriously affected.

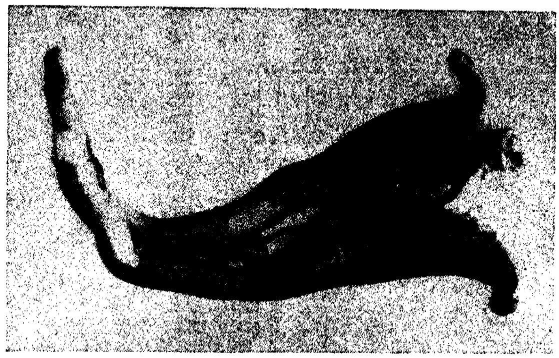


Plate 31.

Caecal Coccidiosis.—Caeca (blind guts) distended with blood and showing haemorrhages in walls.

The caeca of young chickens affected with pullorum disease or older chickens affected with blackhead (histomoniasis) may contain cheesy cores similar to those seen in coccidiosis. Thus laboratory tests may be necessary to differentiate these diseases.

Control Measures.

It is almost impossible to keep chickens entirely free from coccidia. When a chicken ingests a *small* dose of oocysts it usually suffers no appreciable harm, but if the environment favours the spread and survival of oocysts such a bird may initiate an outbreak of coccidiosis. The ingestion of *large* doses of oocysts produces disease.

A small number of oocysts may be brought into a pen by utensils or the boots of an attendant or they may be already present within the pen. A few chickens pick up these oocysts, the parasites multiply within their bodies and then large numbers of oocysts are passed in the droppings. Other chickens become infected and so the pen may soon be heavily contaminated.

Thus to prevent coccidiosis one should aim to—

(*a*) Develop a system of management which prevents the chickens from picking up large numbers of oocysts; and

(*b*) Make conditions as unfavourable as possible for the survival of oocysts.

A large accumulation of oocysts occurs where the droppings of chickens collect, namely under the roosts and around feed troughs and

water vessels. By preventing the birds from having contact with droppings in such places, losses from coccidiosis are reduced. Small mesh wire netting on or under the roosts prevents access to much of the droppings. The netting also prevents chickens from eating any bloody droppings and so enables one to detect a potential outbreak before many chickens are affected.

Feed troughs and water vessels should be constructed and placed so as to prevent the birds fouling the feed and water with droppings.

Dampness of the litter either from water vessels or from rain makes conditions favourable for oocyst survival and may lead to an outbreak of coccidiosis.

Overcrowding increases the contamination of the floor and so increases the chance of the birds picking up massive doses of oocysts.

For chickens reared in intensive pens, thorough cleaning of the pen every two or three days prevents coccidiosis because it removes the oocysts before they have reached the mature infective stage. However, with present labour costs this procedure is often impractical and other preventive measures are now preferred.

It is often difficult to control coccidiosis in flocks reared in semi-intensive yards. The earth floors cannot be cleaned so it is important that overcrowding be avoided and that the yards be absolutely dry in all parts.

Deep dry litter is an effective labour-saving method of controlling coccidiosis in chickens reared intensively. Any good dry litter such as wood shavings or sawdust may be used, but it must be about 6 inches deep. It is thoroughly stirred every day or so and care is taken to redistribute it about the feed and water troughs. Patches of damp or wet litter must be removed immediately. An inch or so of new litter may be added from time to time according to the degree of contamination of the litter already present. The litter may remain unchanged for eight to twelve weeks but a complete new litter should be provided for each fresh batch of chicks.

The effectiveness of deep litter in controlling coccidiosis apparently depends on two factors. Dilution of the droppings by stirring them into the litter prevents the chickens from swallowing big doses of coccidia oocysts. Secondly, the droppings are dried out so that most of the oocysts fail to reach the mature (sporulated) infective stage.

Deep litter may be improved if hydrated (*i.e.*, water slaked) lime is scattered over it at the rate of 10 to 15 lb. per 100 sq. feet every two to four weeks. The lime must be carefully mixed into the litter to avoid burning the feet of the birds.

Mild outbreaks of coccidiosis can usually be controlled by the methods of management described above, but in severe outbreaks it may be necessary to treat with sulphonamides.

Treatment of Coccidiosis.

Sulphaguanidine, sulphamezathine (= sulphamethazine), sulphamerazine, sulphapyrazine, and sulphaquinoxaline have proved effective for controlling caecal coccidiosis. Treatment is applied to minimise losses and yet permit relatively harmless infection so that the chickens

develop immunity. Improper use of these sulphonamides may be costly and disappointing to the owner and harmful to the chickens, so recommended treatments should be followed carefully.

Sulphaguanidine is almost insoluble in water so it is given only in the mash. Treatment with 1 lb. per 100 lb. of mash suppresses the early forms of the parasite but it has little effect after the intestine has started to bleed.

Sulphamezathine and sulphamerazine are very effective for controlling outbreaks because they have their greatest effect on the stage of the parasite that causes bleeding. They have little effect on the sporozoites or the first non-sexual generation, so the infection is not completely suppressed and the bird can acquire immunity to the disease. These two drugs may be administered in the mash or as soluble sodium salts in the drinking water. The soluble sodium salts are available commercially as 16 per cent. solutions, 2 oz. of which added to one gallon of drinking water gives a concentration of 0·2 per cent. of the drug. Treatment through the drinking water is preferred because it is more convenient and because sick chickens will drink although they may not eat.

To allow the birds to acquire an immunity, what is called the interrupted system of medication seems the most suitable. At the first signs of caecal coccidiosis sulphamezathine or sulphamerazine is administered for three days at the rate of 0·2 per cent. of the sodium salt in the drinking water. Normal untreated water is then given for four days and then medication is repeated at the same dose rate for one day. It is important to give the birds treatment for one day after the break of four days, even though they appear healthy. This method usually controls an outbreak but should any symptoms appear during the next week, treatment should be given again for one day.

The above treatment may control mild outbreaks so quickly that a portion of the flock is not exposed to coccidia and so does not develop immunity to the disease. In such cases the disease may re-appear later in the non-immune chickens. To overcome this, overseas workers have recommended that mild outbreaks be treated with 0·2 per cent. of sulphamezathine or sulphamerazine in drinking water on the first day and then half this dosage on the second, third, sixth, and seventh days.

To estimate the quantities of sulphonamides required to treat a group of chickens the following table is given as a rough guide. It should be noted, however, that there is great variation in feed and water consumption under different circumstances.

WATER AND FEED CONSUMPTION PER 100 CHICKENS (WHITE LEGHORNS) PER DAY.

Age.	Water Consumption.	Feed Consumption.
(Weeks).	Gallons.	Lb.
1–2	1	..
2–4	1¼	3–5
4–8	1½	5–7
8–12	2	8–9
12–16	2½	10–15
16–20	3	15–20

At Brisbane prices in January, 1950, the cost of treating 100 chickens for one day with 0·2 per cent. of the sodium salts of sulphamezathine or

sulphamerazine was 4s. 3d. to 5s. for chickens 4-8 weeks old, and 5s. 8d. to 6s. 8d. for chickens 8-12 weeks old.

Chickens drink somewhat less when sulphamezathine is added to the drinking water but there is no evidence of ill effects from reduced water consumption during the period of treatment recommended. Continued treatment, however, is likely to be harmful.

Sulphapyrazine and sulphaquinoxaline have been shown by overseas workers to be effective against coccidiosis but they are not yet available commercially in Australia.

Flowers of sulphur fed continuously in the mash at the rate of 2 per cent. from 4 to 10 weeks of age has been used as a preventative but this is not recommended because of possible harmful effects on growth and development of chicks.

Borax given in the mash at the rate of 2 per cent. or in the drinking water at the rate of 0.3 per cent. (i.e. ½ ounce per gallon) has some preventive but no curative action against coccidiosis. Thus, if used early in an outbreak, borax may protect chickens not yet infected but it will not aid recovery of birds already infected. Borax is cheaper than the sulphonamides but it is much less effective and may retard growth and development, so it is not recommended.

INTESTINAL COCCIDIOSIS.

This type of coccidiosis is usually not as severe as caecal coccidiosis. The disease is seen most often between 8 and 12 weeks of age but birds of all ages may be affected.

The parasite responsible for intestinal coccidiosis is *Eimeria necatrix*, but several other less harmful species of coccidia also infect the small intestine.

Affected birds lose condition and become weak and anaemic with ruffled feathers and the shanks become pale and dry. The droppings are slimy and greyish but do not contain visible blood. In occasional severe outbreaks deaths occur suddenly but usually the birds are sick for many days and deaths are spread over a few weeks. Intestinal coccidiosis is sometimes the cause of pullets 3 to 4 months of age becoming unthrifty and "going light."

The upper half of the small intestine is the site of the disease. The intestine is dilated and its wall is thickened and flabby. Haemorrhage occurs in severe cases, so free blood may be found within the intestine. However, the blood is usually digested lower down in the intestine and so is rarely recognisable in the droppings. A feature of coccidiosis due to *Eimeria necatrix* is the presence of greyish white spots, pin head to match head size like fig seeds, which are visible from the outside of the intestine. These spots are colonies of coccidia lying deep in the wall of the intestine.

Although most farmers quickly recognise caecal coccidiosis, they frequently overlook the intestinal form because of the absence of blood in the droppings or other striking symptoms. Intestinal coccidiosis is diagnosed by careful post-mortem inspection of the unopened intestine to detect the colonies of coccidia.

Symptoms similar to those of intestinal coccidiosis may be due to roundworm or tape worm infection, blackhead (histomoniasis), certain forms of the leucosis complex or incorrect feeding. Post-mortem examinations should be done to determine which disease is present.

Little experimental work has been done on the prevention and treatment of intestinal coccidiosis but the methods used for caecal coccidiosis have given good results in outbreaks on farms.

FEEDING IN RELATION TO COCCIDIOSIS.

Poorly nourished chickens have low resistance to coccidiosis, worms and other diseases. If the ration fed to chickens is deficient in protein or vitamin A or riboflavin, the flock is apt to suffer severely from coccidiosis. The best ration procurable is therefore always a wise investment. It should contain 18 to 20 per cent. of protein for birds up to 8 weeks of age and adequate amounts of other nutrients, especially vitamin A and riboflavin, as set out in the Departmental pamphlet "Poultry Nutrition: Principles and Practices."

Although outbreaks of coccidiosis can now be quickly controlled with sulphonamides, it is always wise, when outbreaks occur, to check the ration carefully to make sure that it supplies all the nutrients required for rapid growth of chickens.

COCCIDIOSIS OF ADULT FOWLS.

Occasionally adult fowls suffer from coccidiosis. The first half of the small intestine is affected. The species of coccidia responsible is usually one other than *E. tenella* and *E. necatrix*, the common species in chickens.

The affected birds become listless and thin and the comb is pale, dry and shrivelled. Diarrhoea is usually present. The wall of the intestine is flabby and its lining has a furry or velvety appearance.

Usually only a few cases occur at any one time in a flock of adults.

Coccidiosis in adult fowls is usually associated with a lowering of resistance by malnutrition, especially vitamin A deficiency, overcrowding, insanitary conditions or attacks of other diseases. Thus the first step in controlling coccidiosis among adults is to correct any of these predisposing factors. Affected birds may be either culled or removed to a quarantine pen and treated with sulphamerazine or sulphamezathine.

CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Agricultural Chemistry

Storage and Disposal of Poisons and Their Containers

C. W. R. McCRAY and G. A. WYATT, Analysts, Toxicological Section, Chemical Laboratory.

THE climatic factors in Queensland which are beneficial to the cultivation of food crops and the rearing of stock are, unfortunately, responsible for the prolific growth of animal and plant pests.

The growth of such pests must be kept in check. Their eradication requires very large quantities of poisonous substances, many of which do not discriminate between unwanted and desirable forms of life.

Thus land holders are forced to use substances poisonous to stock and the question of storage or disposal of dangerous residues is important. Careless storing, handling and disposal of such poisons have been causes of serious stock losses.

Arsenic, in one or other of its forms -dip concentrates, weed killers, Paris green or arsenate of lead—is the commonest and most persistent poison encountered and carelessness in its use accounts for most of the stock losses investigated in this State.

Careless Storage.

Tins and bags containing arsenic or other poisons are often stored in sheds or barns until corrosion or rotting causes their contents to spill or leak out. Many mortalities have been traced to contamination of food by these broken containers.

Because usually only the more valuable stock are hand fed, such losses are serious not only to the owner but also to the industry.

Other common storage places are the beams and shelves of outbuildings. These poisons, often unlabelled, are soon forgotten and in "tidying up" may be carelessly thrown aside, thereby contaminating pastures or making a hazard of a dump.

This danger is increased when properties are sold, for the new owners are less aware of the risk.

Correct Storage.

All poisons should be kept together in a recognised "poison place" and securely locked. They should be stored in strong containers to minimise breakage and loss. Containers should be labelled "POISON" and the name of the poison and its uses should also be indicated. If necessary both label and containers should be renewed as the markings fade or become indistinct.

Careless Disposal.

Even after use some poison containers are still a potential danger, and careless disposal has contributed to many mortalities. The most common form of disposal is the "rubbish dump," which is usually situated on a piece of waste land. Each year as favoured pastures are eaten out, the stock may range onto this waste ground, or new purchases, often valuable, are drawn by curiosity or strangeness or are attracted by the smell of linseed oil residues to places not usually frequented by the rest of the herd. In these circumstances the danger is real—drinking rain water from "empty" poison containers, licking broken bags or old lead paint tins have each been followed by deaths. In addition, deaths have resulted from stock licking poisoned timber.

The burning of poison containers before dumping does not in all cases reduce their potential danger.

Correct Disposal.

The safest method of disposal is by burial.

All poison residues, used containers and materials, unknown or suspected of being poisonous, should be buried as deeply as possible. The site of burial should be chosen carefully so that rain seepage will not cause these poisons to contaminate pastures or watercourses.

Conclusion.

Most of the stock poisonings investigated in this laboratory are due to carelessness during transport, storage, use or disposal of poisons.

In general, land owners respect the instructions and dose rates as directed but, "out of sight, out of mind" is too often a factor contributing to carelessness in storage and disposal both of these poisons and their containers.

TUBERCULOSIS-FREE CATTLE HERDS

(AS AT 15th JUNE, 1950.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas.
Jersey	W. E. O. Meier, "Kingsford" Stud, Rosevale, via Rosewood.
A.I.S.	F. B. Sullivan, "Fermagh," Pittsworth.
Ayrshire	L. Holmes, "Benceeula," Yarranlea.
A.I.S.	D. Sullivan, Rossvale, via Pittsworth.
A.I.S.	W. Henschell, Yarranlea.
A.I.S.	Con O'Sullivan, "Navillus Stud," Greenmount.
Jersey	J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount.
Jersey	J. F. Lau, "Rosallen Jersey Stud," Goombungee.
A.I.S.	H. V. Littleton, "Wongalee" Stud, Hillview, Crow's Nest.
Jersey	G. Harley, Hopewell, Childers.

ASTRONOMICAL DATA FOR QUEENSLAND.

AUGUST.

By W. J. NEWELL, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.30	5.18	Cairns	17	41	Longreach	29	40
6	6.27	5.21	Charleville ..	26	28	Quilpie	36	34
11	6.23	5.23	Cloncurry	41	58	Rockhampton ..	4	16
16	6.19	5.26	Cunnamulla ..	30	28	Roma	16	18
21	6.14	5.28	Dirranbandi ..	21	17	Townsville ..	15	35
26	6.10	5.31	Emerald	14	24	Winton	33	47
31	6.04	5 33	Hughenden ..	26	44	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	8.20	8.27
2	9.16	8.56
3	10.11	9 25
4	11.05	9.53
5	11.59	10.22
6	..	10.55
	a.m	
7	12 54	11.31
		p.m
8	1.51	12.12
9	2.47	12.59
10	3.42	1.51
11	4.34	2.49
12	5.21	3.50
13	6 04	4 53
14	6 41	5.55
15	7.16	6 57
16	7 49	7.58
17	8.21	9 00
18	8.54	10 04
19	9.29	11.10
20	10.09	..
		a.m
21	10.56	12.18
22	11 49	1.27
	p.m.	
23	12 48	2 33
24	1.54	3.34
25	3.01	4,27
26	4 06	5.12
27	5 08	5.51
28	6.08	6 25
29	7 04	6·56
30	7.59	7.24
31	8.54	7.52

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS)

Charleville 27, Cunnamulla 29; Dirranbandi 19; Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS)

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	21	16	37	31	12	7	43	35
6	13	25	28	41	3	16	31	47
11	9	30	25	45	0	21	26	53
16	18	19	33	35	9	10	38	41
21	29	11	45	25	20	0	52	28
26	27	12	43	26	18	1	50	29
31	23	17	39	32	14	8	45	37

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	34	22	53	45	38	30	28	19
3	23	32	46	53	30	38	20	28
5	13	42	39	59	24	44	12	36
7	9	51	37	64	21	50	8	43
9	2	55	33	67	17	52	3	45
11	2	55	33	67	17	52	3	45
13	9	47	37	62	21	47	8	39
15	20	36	43	55	28	40	17	31
17	31	24	51	46	35	31	25	21
19	43	11	59	38	44	23	36	11
21	53	6	67	34	50	20	44	7
23	57	0	69	31	53	16	47	2
25	52	4	66	33	50	19	43	5
27	42	13	58	39	43	24	35	13
29	31	24	51	46	35	32	25	21
31	20	34	43	54	28	39	17	29

Phases of the Moon.—Last Quarter, August 6th, 5 56 a m , New Moon, August 14th, 2.48 a.m.; First Quarter, August 21st, 1.35 a.m ; Full Moon, August 28th, 12.51 a m.

On August 15th the Sun will rise and set about 17 degrees north of true east and true west respectively, and on the 2nd and 17th the Moon will rise and set almost at true east and true west respectively.

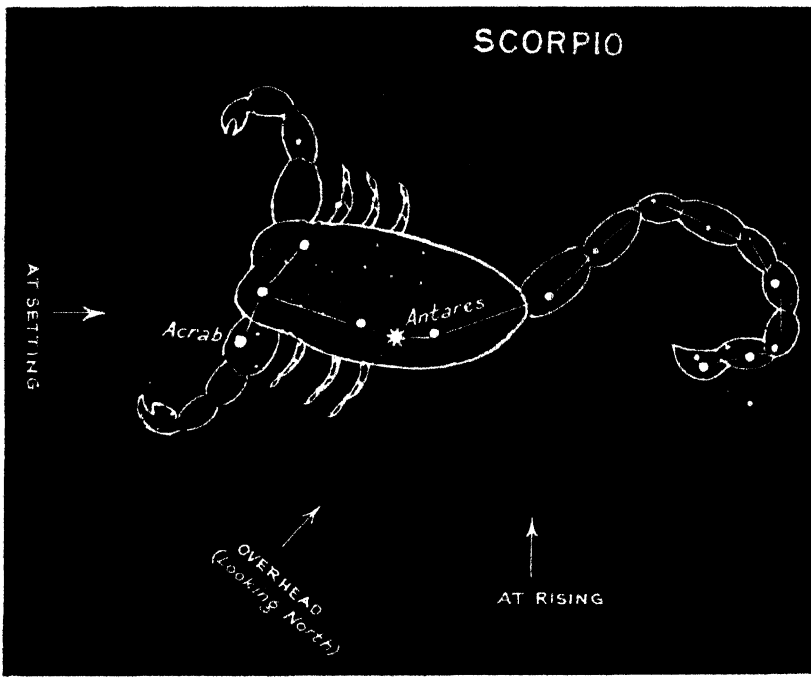
Mercury.—At the beginning of August, in the constellation of Leo, will pass 1 degree north of Regulus and will set about 1½ hour after the Sun, reaching greatest angle east of the Sun on the 21st, when it will set over 2 hours after the Sun. By the end of the month, in the constellation of Virgo, it will set 1 hour 51 minutes after the Sun.

Venus.—Now swiftly approaching the Sun; on the 1st in the constellation of Gemini rising 1¾ hour before the Sun and on the 31st, in the constellation of Cancer, rising 26 minutes before sunrise.

Mars.—In the constellation of Virgo, now seen in the western evening sky, on the 1st of August setting between 11 p.m. and midnight and on the 31st between 10.30 p m. and 11.30 p.m.

Jupiter.—Now a brilliant object in the eastern evening sky at the beginning of the month, rising a couple of hours after sunset, and at the end of the month rising an hour or more before sunset.

Saturn.—Too close to the Sun for observation.



The Constellations.—For some months star charts showing the positions of the more important stars and constellations have appeared in this journal and readers should now have a knowledge of their relation as well as the times and seasons they are above the horizon. From this issue star charts will be replaced by detailed descriptions of the constellations and that chosen for this month is the constellation of Scorpio (sometimes written Scorpius), which at this time of the year is about overhead at nightfall. It will be noticed that the constellations are slightly farther west at the same time after several night's observation, the amount being about 30 degrees every month, so that by December Scorpio will set about sunset, and it will reappear in the eastern morning sky in January. This constellation is perhaps the easiest to recognise in the sky and the only one which in any way (except the cross) resembles what it represents—a scorpion—the curved form shown by the fine line in the drawing being most striking. It covers 30 degrees of the sky and was believed by the Greeks to represent the horrible scorpion that frightened the horses and brought disaster to Phaeton when driving the Sun chariot of his father, Phoebus Apollo. Being situated in the Milky Way it has a background of thousands of small stars and some very interesting clusters and nebulae are found in it which even with small optical aids, such as binoculars, give many pleasant hours of interesting observation. Antares, the most brilliant star in this constellation, is one of the largest stars known, with a diameter of 370,000,000 miles (almost 500 times that of our Sun) which will cover the whole of the orbit of Mars. This star has a companion star which is only 3 seconds away and green in colour. It is easily seen in a telescope of 5 or 6 inch diameter. At certain periods the Moon's orbit passes so close to Antares that an eclipse of that brilliant star by the Moon—known as an occultation—is observed. On 11th February and 7th April of this year there was an occultation of Antares, and a further occultation occurs on the night of August 21st. The changing position of the curve of this constellation in relation to the horizon as it moves from east to west is most interesting. The arrows on the accompanying diagram show the direction perpendicular to the horizon at rising, at transit and at setting.

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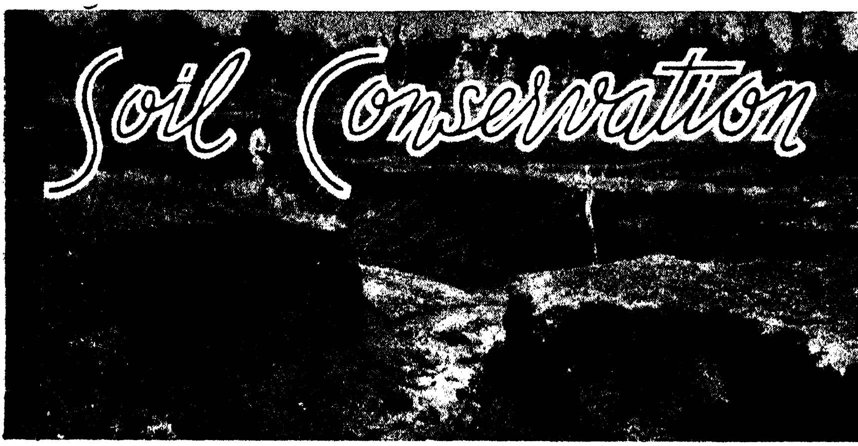
Contents



Soil Conservation in Queensland.

J. E. LADEWIG, Senior Soil Conservationist, and A. F. SKINNER, Soil Conservationist.

5. Contour Banks.

In preceding articles in this series, due emphasis has been placed on the fact that soil conservation is essentially a commonsense matter of using land for purposes for which it is best suited, or, in other words, of making due allowance for the limitations to its permanent safety and security from erosion imposed by topographical and climatological conditions.

A second basic necessity for the defence of cultivated land against erosion is a sound system of soil husbandry. This is essential for the maintenance of its vitality and physical characteristics if it is to retain its capacity to rapidly absorb rainwater as it falls and thus reduce soil and water losses to a minimum.

These matters are of paramount importance in the prevention of soil erosion and have been repeated at the commencement of this section on contour banks, because of the tendency of farmers to accept the latter as a "cure-all" for erosion and often as a substitute for planned systems of rotational cropping and proper soil management.

Surface drainage schemes cannot be expected to do more than prevent for a time the accumulation of damaging concentrations of water in depressions down the slope and thus check the ultimate development of gullies. *Drainage schemes alone cannot control the insidious process of sheet erosion, which, although less spectacular than gully erosion, is often more serious.* A combination of contour drainage with soil protecting and soil building farming methods is, however, of maximum value in reducing soil and water losses from sloping cultivated land.

The type of drainage structure most commonly used on cultivated land is the *contour bank,* which is also widely referred to elsewhere as either a *graded bank* or a *contour terrace.*

Contour banks serve to intercept runoff water at frequent intervals down a slope before it gains erosive velocity, and then divert it at a very low rate around the slope to a safe point for disposal. They are so named because they closely follow level lines or contours. To obtain the necessary gradient for drainage to either one or both ends of a bank, a slight deviation from the true contour is made.

All ploughing, planting, and cultivating operations should be performed in strips between, and parallel to, the banks. *In no circumstances should tillage implements be operated over the banks* Contour working of the land is necessary, not only for the protection and maintenance of the banks, but also to assist in reducing runoff. Each implement tyne mark, being approximately level, acts as a small dam which serves to trap and hold some water that would otherwise be lost.

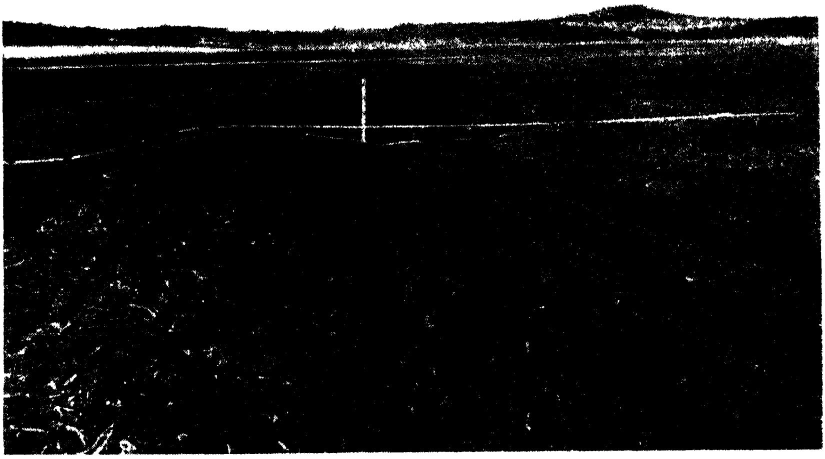


Plate 32.

A Contour Bank on the Darling Downs.—Note that tyne marks are parallel to the bank and so act as a number of miniature dams.

Contour banks on cultivated fields divert water from a short direct downward course to a much longer and indirect course around the slope. In addition to the advantages already indicated, two other benefits are derived from this drainage plan. Firstly, it helps to reduce the risk of damage to lower land and to watercourses by reducing the final concentrated volume of runoff.

By causing runoff water to follow a long, indirect course around contours, it will be apparent that by the time water from remote parts of a field arrives at the bottom the runoff from lower parts of the same field will have escaped. In such circumstances the load on drainage depressions (and the attendant risk of damage) will be appreciably less than it would be if the water followed the most direct course from the same field In this way the rapid accumulation of water into turbulent torrents can be largely prevented.

The second benefit derived is the absorption of additional moisture by the soil along each contour bank channel due to the additional time that the water is held on the land.

TYPES OF BANKS.

Various types of contour banks may be utilised for soil conservation purposes, the type chosen depending on soil type, degree of slope, and prevailing agricultural practices.

The one most commonly used is the broad base bank, usually constructed on gentle slopes, where soil for the bank is obtained almost equally from both sides of the centre line of the bank. This bank finds general application on soils which tend to crack when dry. It is particularly suitable for cereal-growing areas, where cultivation and sowing operations can be conducted along the length of the bank and channel.

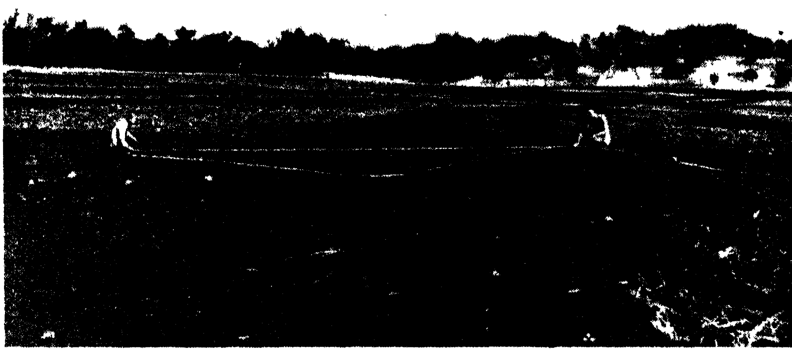
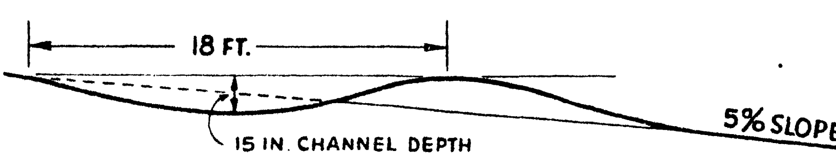


Plate 33

A Typical Broad Base Contour Bank on a 6 Per Cent. Slope.—This ype of bank is well suited to cereal agriculture

Where weed control presents problems, it is important that the dimensions of the bank be sufficient to enable standard farm implements to be worked along the bank and channel without "bridging."

The following diagram shows suitable dimensions for a bank of this type constructed on a 5 per cent slope



Under certain conditions narrower banks with a more abrupt upper face are justified because of lower construction costs. The cropping of the whole of such banks is usually not possible; to inhibit weed growth on banks of this type, they are usually sown to a permanent

cover of grass. In succeeding years it is often possible to gradually increase the size and shape to more closely approximate the type indicated above.

On the very steep arable lands of the State, where the construction of the orthodox type of broad base bank is a practical impossibility, a smaller bank with a deeper and narrower flat-bottomed channel is necessarily utilised (Plate 34).

Plate 34.

The Type of Bank Most Suitable for Slopes in Excess of 10 Per Cent.

PLANNING THE CONTOUR BANK SYSTEM.

The first step in planning a system of contour banks is to make a careful examination of the physical features of the area. Natural drainage depressions or potential waterway sites are an important consideration, as are also degree of slope, ridge, paddock and property fence lines, and the situation of roads, buildings, &c. Overlying catchment areas must be examined with a view to determining the need for diversion or other structures, and lower areas examined in respect of disposal of water. In the preliminary planning, all necessary contour banking for the whole farm must be considered, so that it can be dovetailed into the complete farm plan; any necessary rearrangement of fences, roads, &c., should be planned at this juncture.

In this planning, immediate consideration must also be given to the question of access for implements, stock, &c., to all parts of the farm; as a general rule the access to a field should be at a point most remote from the outlet or waterway end of the banks. This is to ensure that the banks will be crossed at their origin end, where they will be carrying a minimum amount of water; it will be apparent that banks carry a maximum flow at the outlet end and must not be weakened at this point by the passage of traffic.

The installation of a contour bank system should not go beyond the planning stage unless a stable outlet is available or until a waterway has been constructed and vegetated. With the water disposal systems in order, contour bank lines may be marked out and construction proceeded with.

MARKING OUT CONTOUR BANK LINES.

For marking out contour bank lines some kind of levelling instrument is necessary. Many simple devices have been designed for use by farmers in surveying contour bank lines, but in general it is unwise to utilise makeshift devices for the designing of permanent structures such as these. It is preferable to utilise accurate instruments even though the initial surveying cost may be higher; a reasonably accurate surveying instrument is now available at a cost of £40, which is within the reach of farmers on a group basis.

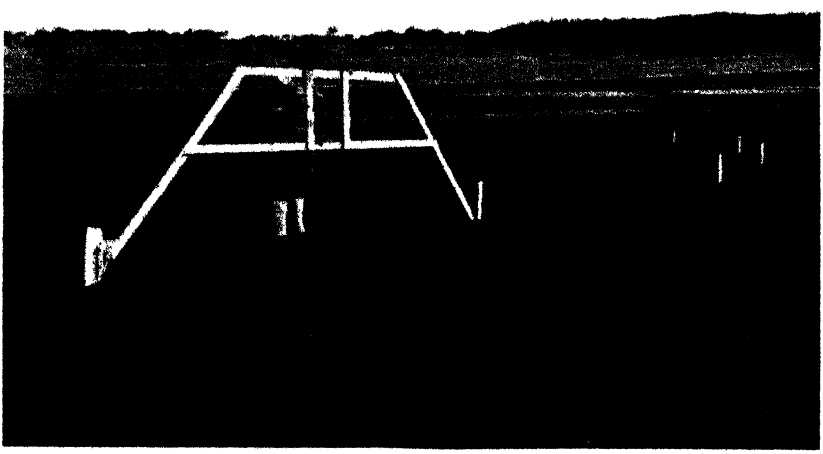


Plate 35.

A Home-made A Frame Level.—This was once used extensively but has now been superseded by accurate modern instruments.

When surveying lines for contour banks, it is necessary to first determine the slope of the land at the site of the first bank preparatory to selecting the proper spacing for the banks. Bank spacing is then determined by examination of Table 1. Wider experience under Queensland conditions may necessitate modification of this spacing table, but for the present it represents a safe, yet practical, spacing formula.

Provided that sound cropping systems are practised and that all ploughing and cultivating is done on the contour, it is possible to increase these spacings under certain conditions.

TABLE 1.

DISTANCES BETWEEN CONTOUR BANKS ON VARIOUS SLOPES.

Slope.	Vertical Interval.	Horizontal Distance.
Per cent.	Feet.	Feet.
2	4·00	200
3	4·50	150
4	5·40	135
5	6·00	120
6	6·30	105
7	6·65	95
8	6·80	85
9	7·20	80
10	7·50	75

Having decided upon the correct spacing of banks for the particular area, the next matter for consideration is the gradient or fall which will be required to safely transport the anticipated runoff without risk of either scouring the channel or of overtopping the bank.

For agricultural areas of moderate slope, and particularly where long banks are intended, a variable grade is recommended. This simply means that the fall is progressively increased towards the outlet end to cope with the additional volume of water carried. Normally, the gradients used vary from almost level at the origin end to a maximum of 6 inches per 100 feet of bank length at the outlet end. The last 20 feet of bank at the outlet should have an additional fall of from 9 to 12 inches to compensate for the channel excavation and to ensure the free escape of water into the grassed waterway.

As an example of the above, a bank 900 feet long would be designed with a fall of 1 inch per 100 feet for the first 300 feet, 2 inches per 100 feet for the second 300 feet, and 3 inches per 100 feet for the third 300 feet, with an additional fall of 9 inches in the last 20 feet. A bank 1,500 feet long would have a fall of 1 inch per 100 feet in the first 300 feet, 2 inches per 100 feet in the second 300 feet, and so on up to 5 inches per 100 feet in the last 300 feet.

In special cases, particularly on the very steep horticultural areas, steeper gradients than the above are utilised. These will be dealt with in a subsequent article.

With respect to bank length, it is preferable that they should be of maximum safe length to facilitate cultural operations by reducing the amount of turning to a minimum. On the other hand, short banks do not have to carry nearly as much water as long banks and are therefore safer and need not be as large. In normal practice a bank length of 2,000 feet should not be exceeded. Where a bank is divided in the centre and drains both ways, the total length can obviously be doubled.

With the design features decided, the first bank is marked out at the necessary distance (as shown in the table) below the protective diversion bank or crest of the slope.

As far as practicable the bank should be surveyed from the outlet end.

Plate 36.
Surveying a Bank Line Using a Simple Levelling Instrument Costing About £10.

Having established the starting point of the top bank at a site near the outlet end, the line is run back across the paddock, readings being taken every 100 feet in even country and every 50 feet where the topography is irregular.

The method advocated is the use of a suitable surveying level and staff. The staff-man places the staff on the peg near the outlet end, and with the level set up about 300 feet along the anticipated bank line a reading is taken and the target on the staff moved to the desired position.

Plate 37.
Surveying a Bank Line with an Accurate Modern Instrument.

The staff-man now paces 100 feet towards the level, moving the target on the staff downwards the number of inches of gradient to be used; a reading is taken and the staff-man moves up or down slope until the target on the staff is in line with the cross-hair of the level. This procedure is repeated across the field until the staff-man is 300 feet on the other side of the level. At this point the level is set up a further 300 feet beyond the staff-man and a backsight reading taken on the staff, the target being moved up or down on the staff until it is in line with the cross-hair of the level. The process is repeated until the bank is marked out completely. To mark the site of the next bank the level is set up at the outlet end, the per cent. slope determined, and the distance measured as before. This is pegged, and the second bank marked in the same manner as the first.

A target on the staff is not a necessity, as direct readings may be taken on the staff with the level and the gradient allowance made by the man operating the level. Farmers contemplating this work are advised to request the advice and assistance of the nearest officer of the Department of Agriculture and Stock.

THE CONSTRUCTION OF CONTOUR BANKS.

The anticipated time and cost involved in the construction of contour banks often act as a deterrent to their adoption on many of the farms where they are most required; however, experience has indicated that they can be constructed quite satisfactorily with a very wide range of implements and the cost factor varies accordingly. The method to be adopted will depend largely on the topography and the extent of gully erosion present on the land prior to treatment, and upon the financial and equipment resources of the landowner.

Where large earthmoving plant is utilised, the construction of contour banks and the associated gully filling and land levelling work can be carried out efficiently and expeditiously; immediate expenditure may be high, but the speed and ease of execution usually justifies this outlay. The cost of reclamation on severely eroded fields where extensive gully filling and levelling work is involved may exceed £5 per acre, but on the other hand, where only minor erosion damage has occurred or where the soils are more suitable for earthmoving, the cost may not exceed £1 per acre.

These reclamation works can be effectively executed by farm tractors of suitable horse-power either with farm dozers attached or drawing either a multiple furrow plough or a small grader. When the work is done with this equipment it is much slower than with large earthmoving plant, but it possesses the saving advantages that it can be executed in sections, at times convenient to the farmer, and for a much lower "out of pocket" expenditure. Although different types of light dozer attachments for farm tractors are now on the market, many farmers in Queensland have successfully designed and constructed their own.

Banking a Gullied Field.

Before contour bank construction is commenced on a badly eroded field, it is usually necessary to at least partly fill the gullies and carry out some initial levelling work. Care should be exercised to ensure that the filling and levelling is done in sections so that the levelled area does not extend for more than 150 feet below the last completed bank; this will avoid serious losses should erosive rains fall before the banking programme is completed.

Plate 38.

A Home-made Dozer Attached to a Farm Tractor being used in the Construction of a Diversion Bank.

Where large gullies are to be filled, a dozer unit is usually necessary; small dozers attached to farm tractors will execute this work satisfactorily if the gully edges are ploughed beforehand. The final levelling of the field can be most effectively done with the various types of "levelling boards" normally used to level land for irrigation purposes.

Building Contour Banks with a Plough by the Island Method.

The construction of contour banks with any type of implement can usually be most efficiently performed where the Island system of construction is adopted, and this applies particularly where farm ploughs are the implements used. When this system is utilised a strip of unploughed soil is left, on which the contour bank is finally built; by adopting this method a considerable amount of earthmoving work is avoided.

On the steeper arable lands of the State, or where slopes exceed 6 per cent., it is most economical to form the banks by moving the entire mass of soil from the upper or channel side. The Island method will not apply to these slopes, and construction methods for these will be described later.

Because of the large volume of soil that must be moved, it is important that the plough have ample beam clearance, and to avoid difficulty in ploughing operations heavy surface stubble should be raked aside before starting to plough.

The number of rounds to be made will depend on the size of the plough and the efficiency of operation; a five-furrow disc plough has been used for the purposes of this publication, but appropriate allowances can be made where ploughs of other dimensions are used. In order to more clearly describe the construction method the pegs have been replaced after each round of the plough so that the published photographs will illustrate the relative position of the bank to the pegged line.

First Series of Three Rounds:

The first trip of the plough is made with the tractor centreing on the line of stakes which have previously been placed, during the survey, to establish the grade line of the contour bank. When the bank is completed, a point about half-way up the top side of the bank will correspond to the original survey line.

When the far end of the bank has been reached, the stakes are moved downhill to mark the width of a uniform island illustrated in Plate 39; if desired, the island can be marked at the time the upper line is being surveyed. The width of the island varies according to slope and width of bank desired, as is indicated in Table 2.

Plate 39.

A uniform width for the island may be marked by two men carrying a rope or stick of the required length, one tracing the path of the original survey line, the other placing stakes below it at the other end of the measuring device. A modification of this method may be adopted by utilising an implement of the appropriate width, and the bottom edge of the line marked by that implement becomes the guide line for the return trip.

TABLE 2.

SUGGESTED ISLAND WIDTHS FOR DIFFERENT SLOPES.

Slope.	Island Width. Feet.
3 per cent. or under	12
4 per cent.	11
5 per cent.	10
6 per cent.	9
7 per cent. or over	8

Plate 39 shows the first round in the building of a bank where the marking out on the return trip is almost completed. Two complete rounds now follow, so that at the commencement of round 4, fifteen furrows have been turned downhill on the top side and 15 furrows uphill on the lower side of the island. If a two-disc plough were used, this would represent seven rounds; for a three-disc, five rounds.

Second Series:

After completing three rounds (15 furrows), the plough is utilised to roll the soil on to the island; the plough is advanced 12 inches closer in on the island to commence this round.

Plate 40.

Plate 41.

Plate 40 shows this being done on the upper side, and Plate 41 indicates the same procedure on the lower side.

A further two rounds advance the soil mass 12 inches closer to the island, and complete a total of 15 furrows (seven rounds with a two-disc plough) for the second series.

In a previous publication, "Building Contour Banks with a Plough by the Island Method," a system was described in which there was no "step in" to the island on the bottom side for rounds 4, 5 and 6; whilst that method is quite effective, it tends to leave a hollow on the lower side of the bank which is reduced in the method now being described.

Plate 42.

Plate 43.

Third Series:

For the third series the plough is again advanced 12 inches further on to the island on both the upper and lower sides; the first half of this round (upper side) is illustrated in Plate 42, and the second half (lower side) in Plate 43.

A further two rounds are necessary to complete the third series of 15 furrows; a total of seven rounds for this series if a two-disc plough is used.

Fourth Series:

In this series the plough is again advanced 12 inches further on to the island on the upper side, but in this series no "step in" is made on the island on the lower side; ploughing is simply continued out into the field on the lower side. The operation on the upper side is shown in Plate 44.

Plate 44.

A further two rounds follow, moving soil in towards the island on the upper side, and ploughing out into the land on the lower. This completes 15 furrows for the fourth series, representing seven rounds for a two-furrow disc plough.

Fifth Series:

The plough is again advanced 12 inches on to the island on the upper side, as illustrated in Plate 45, and with a "step in" of 12 inches on the lower side, shown in Plate 46.

The channel begins to form as the dead furrow widens on the upper (right) side, and the island of unploughed soil has almost disappeared; a further two rounds on upper and lower sides complete this series.

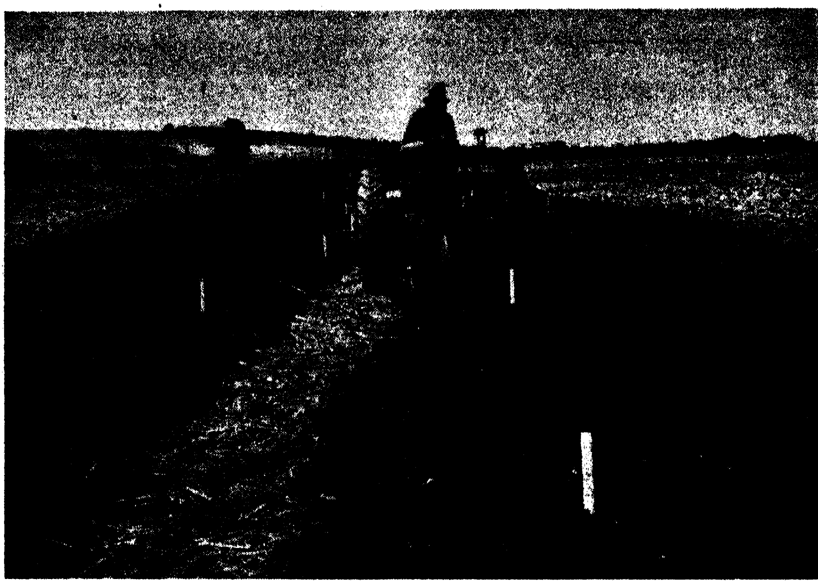


Plate 45.

Plate 46.

Sixth Series:

In the opening round of this series, the plough is advanced so that the soil from upper and lower sides meets as a crown. In this series the opening run is done on the lower side to reduce the difficulty of throwing soil up slope against the crown (Plate 47); the return run of this round then completes the crown for the upper side (Plate 48).

Plate 47.

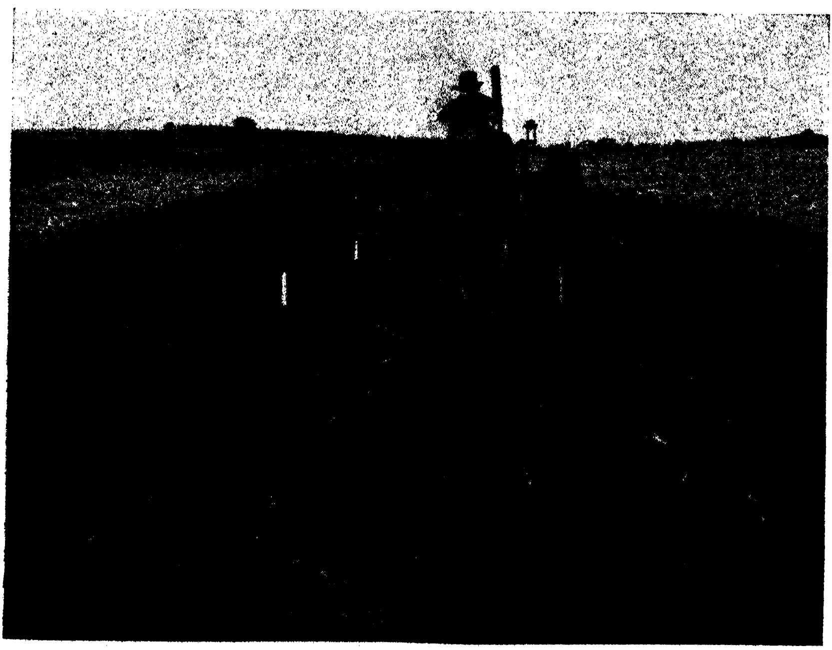


Plate 48.

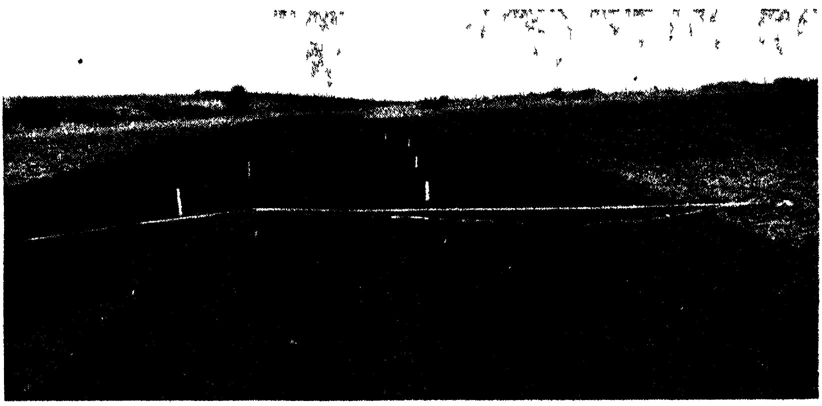


Plate 49

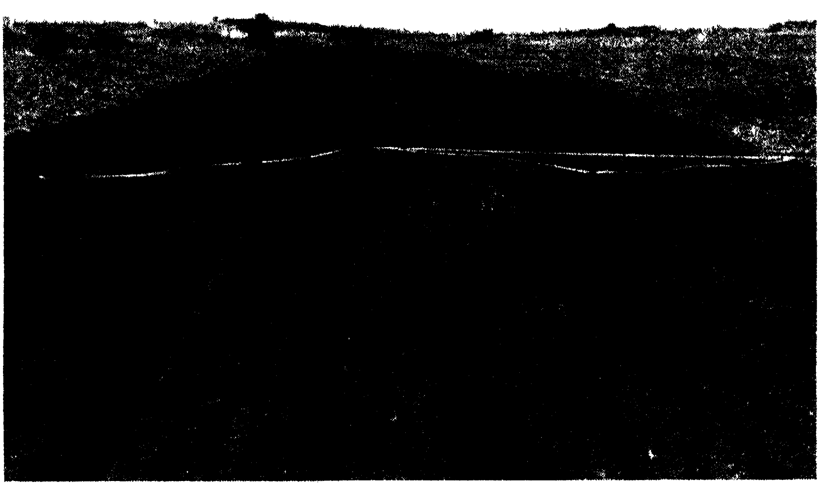


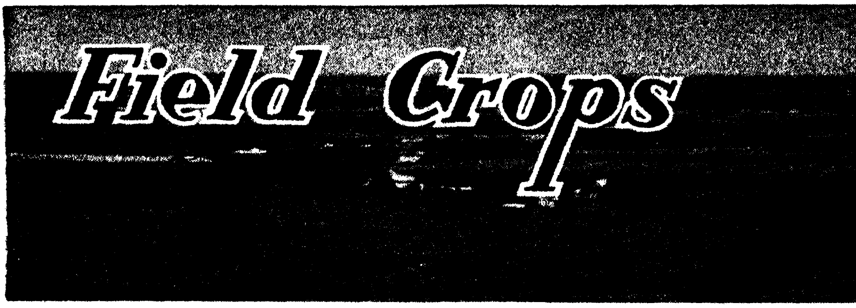
Plate 50

The remaining two rounds of this series complete the bank insofar as plough work is concerned.

Plate 49 shows the completed bank at the end of the sixth series, including a total of 18 complete rounds with a five-disc plough; this represents 42 rounds with a two-disc or mouldboard plough, and 30 rounds with a three-disc plough When a sundercut is used, similar principles apply, though the "step in" allowed is usually less and a slightly wider area is ploughed.

The appearance of plough built banks may be improved by the use of a light grader drawn by a farm tractor, to trim off irregularities, provide a better cross-section, and to improve the capacity of the bank. Plate 50 shows the completed bank after two trimming rounds with a grader ditcher.

[TO BE CONTINUED.]



Agriculture in the Fassifern Area.

W. G. STEELE, Senior Adviser in Agriculture.

THE area to be discussed in this article extends from Harrisville, sixteen miles due south of Ipswich, to the McPherson Range on the Queensland-New South Wales border, a distance of approximately thirty miles. The western boundary, except for a few miles at the northern end of the district, is the Main Dividing Range, which along this section contains some of the highest peaks in southern Queensland. Spicer's Peak, Mt. Huntley and Mt. Roberts are all over 4,000 feet. On the eastern side, the hills of the Teviot Range, halfway between Boonah and Beaudesert, form the boundary of the district. Thus the district is actually situated in the angle formed by the junction of the McPherson and Main Dividing Ranges, and consequently the greater portion of the area consists of more or less elevated country interspersed with small valleys and creek flats.

The railway line from Ipswich branches at Munbilla, approximately 25 miles from the city. One branch traverses the hills and terminates at Dugandan, one mile beyond Boonah, and the other swings a little to the west, descends fairly rapidly to the floor of the valley, and passes through Kalbar, Fassifern and Aratula to Mt. Edwards.

Settlement of the district commenced shortly after 1840, when grazing selections were first taken up. Sheep were tried in the early days but gave way to cattle after a few years. About 1900, dairy cattle were beginning to increase in numbers and a butter factory was established. By 1910, with the introduction of closer settlement, farming had become the main agricultural industry; dairying, pig raising and the cultivation of field crops were the major forms of production, and these still hold pride of place.

The bulk of the land to-day is held on a freehold basis, and very little scope exists for further subdivision. The area is well watered by four main watercourses. Warrill and Reynolds Creeks traverse the district from south to north, and after joining at a point near Kalbar, empty into the Bremer River. The Teviot Creek flows from Wilson's Peak northwards to Boonah and then turns to the east, where it passes through the Teviot Range and runs into the Logan River. Burnett Creek has its source close to the Teviot but does not follow the same direction, as it swings to the east and passes through the Maroon district to near Rathdowney, where it joins the Upper Logan.

CLIMATE.

The average annual rainfall at Boonah over a period of 45 years is 32.68 inches. This can be taken as a fair indication of the registration for an area within a radius of six miles from Boonah, but there appears to be a gradual falling off towards the north, where the Kalbar average is about an inch less than Boonah, with Harrisville two inches lower. In the foothills below the ranges the average yearly rainfall is probably over 40 inches, as rain frequently falls there in the wet season when the bulk of the district receives no rain.

It is interesting to note that records of Coochin Coochin Station, about six miles in a straight line from Boonah, which commence about 1880, show annual falls of up to 50 inches, with an average for the first ten years of about 45 inches. This average gradually declined until by about 1905 it was very close to that shown for Boonah.

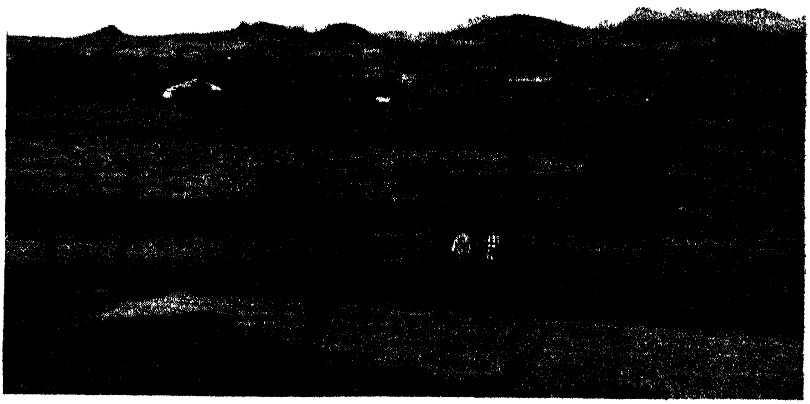


Plate 51.

Farms on Brigalow-Softwood Scrub Country near Boonah.

In common with the general trend for this section of the State, the bulk of the rain falls in the December to March period. In most years, however, the month of June, with an average of about 2½ inches, provides good moisture for winter fodder crops. Generally speaking, periods of actual drought are rare compared with many other districts of Queensland. While summer temperatures are sometimes high, the scrub areas with their moisture retaining subsoils can support crops for fairly long dry periods without serious growth checks. The rainfall in September, October, and November varies considerably from year to year, but storms in this period usually provide sufficient moisture for most crops. Early planted maize crops, however, sometimes suffer as a result of this irregularity. In the winter, frosts are consistent, and these may continue well into August and occasionally September. In the scrub areas, the elevation minimises the risk of late frosts and permits the planting of a number of frost susceptible crops, such as maize, tomatoes and cucurbits, much earlier than on the alluvial country.

SOILS AND VEGETATION.

The area can be broadly divided on the basis of soils and vegetation into three main types of country, which very largely influence the particular types of farming activities carried on in the various districts. These are discussed in the following sections.

Elevated Brigalow-Softwood Scrub Country.

This area extends from just north of Roadvale to Mt. Alford, a distance of approximately 17 miles, and has a width varying from two to eight miles. Roadvale, Teviotville, Kulgun, Kalbar and Templin are the main centres to the north of Boonah, and Dugandan, Milford and Bunjurgen to the east and south.

The soils, which vary in colour from light brown to dark grey, are clay loams overlying stiff clay subsoils; the depth of the surface soil is from four inches to eight inches as a rule. On some of the upper slopes, lighter loams, varying in colour from red to dark brown, are found in small areas. Practically no timber remains on the lower and middle slopes, but is found only on the upper slopes where the land is too steep for cultivation. On the eastern and western upper slopes of Mt. French, between Boonah and Aratula, a heavy cover of lantana exists, but on the main scrub areas this pest is not widespread.

Holdings in the scrub districts are small, generally between 90 and 100 acres, but with many smaller areas down to 60 acres. Dairying, combined with pig raising and the growing of maize, pumpkins and occasional vegetable crops, is the main industry.

The fertility of the soils is high and little use is made of artificial fertilizers.

While steeply undulating in places, the bulk of the land can be ploughed; at times slopes of over 15 per cent. are cultivated. Paddocks as a rule are small, from 2 to 12 acres in extent, and this fact probably accounts for the low rate of soil erosion. Considering the length of time some of the farms have been cultivated, it is surprising that serious erosion has not occurred. The probable explanation is that with the small paddocks there are no long runs of water and with row crops interspersed with cover crops, such as lucerne, cowpeas, oats and other grazing crops, a modified form of strip cropping is achieved. Furthermore, the surface soil for the most part has a well developed structure (that is, it has a good tilth) which favours rainfall absorption and minimises run-off.

Erosion has occurred and is still occurring, however, as evidenced by the yellow, stunted patches frequently seen in sorghum fields in summer and oat paddocks in winter, indicating that the subsoil has been reached. If general soil deterioration is to be prevented, measures must be taken by the farming community to check further loss. The ploughing-in of maize stubble and similar organic material should be adopted by all farmers and burning-off should be discontinued. Cultivation should follow the contours, and gullies should be left in grass. If these methods are followed, it is likely that extensive earthworks will not be necessary.

The Alluvial Flats.

Soils in these areas range from deep sandy loams to heavy clays, varying in colour from light brown to dark grey. The lighter alluvials generally are found along Reynolds Creek in the Charlwood area, and along parts of Warrill Creek near Aratula and Tarome. These are good potato soils. Other sections of the Warrill Creek lands are of a heavier nature and in places the alluvial merges into a heavy "black earth" type. This is particularly so below Kalbar, where the prevailing soil types are clay loams to clays, except for a few chains adjacent to the creek. While such soils are heavier than the normally recognised potato soils, nevertheless they are capable of producing good crops of potatoes. Further down Warrill Creek, on the eastern side near Wilson's Plains and Harrisville, an extensive area of black soil occurs on which lucerne, wheat and oat crops are grown for making into chaff.

Plate 52.

Maize Growing Below Mount French.

Teviot Creek in its upper reaches traverses the heavy clay loams of the Coochin and Bunjurgen areas where lucerne is extensively grown. Cuts of up to 30 cwt. of hay per acre are taken off and in the flush of the season crops may be ready for harvesting four weeks after the previous cutting. Although water is available from the Teviot, most of the lucerne is grown under dry farming conditions.

The total area of first class alluvial soil is estimated at approximately 10,000 acres. The average size of properties in these sections of the district is about 120 to 130 acres. Such farms are usually made up of about 60 to 70 acres of good alluvial soil and the balance of "back" country which runs up onto poorer ironbark ridges or in some cases onto brigalow scrub. In odd cases where potatoes and other vegetables are grown 30 acres constitutes a living area.

Ironbark Ridge Country.

These areas are not cultivated to any great extent, being used mostly for grazing dairy or beef cattle. The soil in the main is shallow, light brown or grey in colour, and with a clay subsoil; sometimes it overlies sandstone at a shallow depth. Narrowleaf ironbark (*Eucalyptus crebra*), spotted gum (*Eucalyptus maculata*) and Moreton Bay Ash (*Eucalyptus tesselaris*), with pitted blue grass (*Bothriochloa decipiens*) wire grasses (species of *Aristida*) and black spear grass (*Heteropogon contortus*), are the main native plants.

A variation occurs near Harrisville, where the low ridges are composed of dark brown to black clay loam to clay soils. This area extends from Harrisville towards Peak Crossing and in places along the main Warwick Road to Amberley. The dominant vegetation comprises silverleaf ironbark (*Eucalyptus melanophloia*) in association with Queensland blue grass (*Dichanthium sericeum*) and pitted blue grass.

WATER FACILITIES.

The four creeks in the district provide ample water in most seasons for stock and irrigation. Practically all farms along Warrill and Reynolds Creeks are equipped with irrigation plants which pump water from the creeks. In most cases the banks are comparatively low and the water is easily reached. Plants are usually 3–4-inch systems, with the spray lines equipped with butterfly sprinklers, although lately some fixed types have been installed. Power for the pumps is usually supplied by tractor or stationary engine, but the extension of power reticulation along Warrill and Reynolds Creeks is permitting the replacement of these units with electric motors. On a number of farms wells have been sunk at various distances from the creeks and ample water obtained for irrigation. These wells enable irrigation to be carried out during dry periods when watering from the creeks is restricted because of low supply. They also permit additional areas of land to be brought under irrigation without increasing the length of main lines required.

The quality of water in Reynolds and Warrill Creeks is good, as also is that of Burnett Creek. The latter passes through a limited area compared with the other creeks but all farmers along its course utilise the water for irrigation.

Along Teviot Creek, irrigation plants are not so numerous. As mentioned previously, the soils for some distance along the creek are of a heavy nature and not ideal for irrigation. Potatoes are not grown extensively in this area and in most seasons lucerne is apparently able to obtain its water requirements without supplementary irrigation. Salt springs entering the creek at several points also apparently affect the quality of the water for some distance and impair its suitability for irrigation.

In the scrub areas water at times is short. In most cases, dams are the main source of supply, with supplementary supplies from bores. Very often the quality of water in the bores is poor and many samples submitted for analysis have shown from 500 to 1,000 grains of common salt per gallon. Bores generally are from 90 to 150 feet deep and yield 500 or more gallons per hour. The majority of dams are of the overshot type and of small capacity; two or three are usually found on each farm. In the winter months, if autumn rains have been less than usual

or have been of a steady nature, run-off is low and dam water becomes short. However, with the assistance of local boring plants and bull-dozers, conditions are improving.

PASTURES.

Native Pastures.

The bulk of the pastures consist of native species, mainly Queensland blue, rare blue (*Bothriochloa intermedia*), pitted blue and windmill grasses (species of *Chloris*). Three-awned spear grass (*Aristida ramosa*), other wire grasses (species of *Aristida*) and black spear grass are found mostly on the poorer ridge country and the blue grasses on the alluvial soils. Other grasses include kangaroo grass (*Themeda australis*), rat's tail or Parramatta grass (*Sporobolus berteroanus*) and love grasses (species of *Eragrostis*) On the scrub areas, where the acreages are small, most of the land is cultivated and the pasture area frequently consists of the poorer and more broken sections.

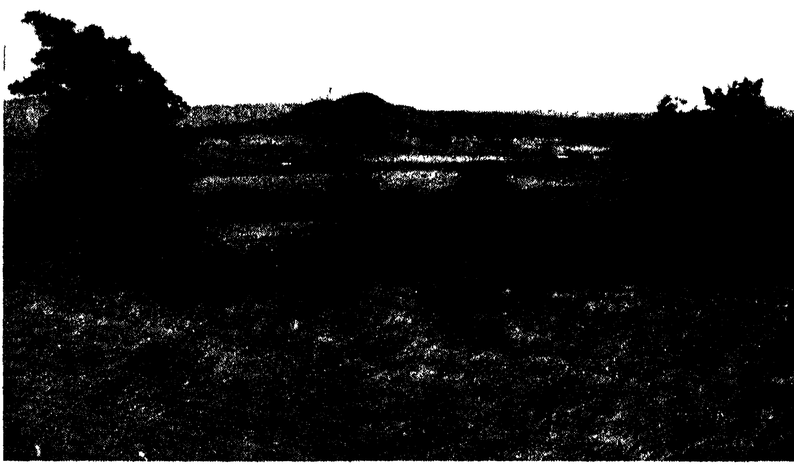


Plate 53

Fassifern Valley Alluvials, from Charlwood.

Introduced Pastures.

Little has been done to improve the carrying capacity of these areas by the development of better pastures and stock owners generally rely on cultivated fodder crops for supplementary feed. Paspalum, however, has become established over a considerable portion of the scrublands and now forms a high proportion of the available pasture on all but the poorest country. It has spread in a similar manner on the better soils of the forest land, particularly adjacent to the watercourses. In most seasons this grass provides a good bulk of feed but is inclined to grow rankly under good conditions, particularly if understocked. This results in the production of a mass of seedheads which are heavily infested with ergot. On scrublands, Rhodes grass (*Chloris gayana*), introduced about 1905, has established itself on country too poor or too dry for paspalum. It appears to be spreading slowly.

Both paspalum and Rhodes grass swards, particularly the former, have become heavily matted and would benefit greatly by renovation and topdressing. Carrying capacity of the better class scrub pastures is estimated at about one beast to three acres, and that of the poorer pasture types one beast to six acres. Beef cattle on the flats and lower slopes are grazed at the rate of about one beast to four or five acres, with one beast to ten acres on the ridges. On several scrub farms small sowings of kikuyu grass (*Pennisetum clandestinum*) have made excellent showings and this grass could be planted more extensively. Odd patches of Para grass (*Brachiaria purpurascens*) have also done well. In the winter, Toowoomba canary grass (*Phalaris tuberosa*) grows rapidly and provides a good body of feed. Trial sowings of Wimmera rye grass (*Lolium rigidum*) have not produced encouraging results.

Pasture Legumes.

Native species include two twining types—rhynchosia (*Rhynchosia minima*) and glycine pea (*Glycine tabacina*)—and tick trefoils (species of *Desmodium*), none of which gives sufficient bulk to be of much benefit; a species of Lespedeza also occurs which shows some promise and is readily eaten by stock. The naturalised burr medic (*Medicago denticulata*) and a small species (*Medicago minima*) are the outstanding legumes in the winter and spring pastures. If ample rain falls in the autumn, a very large body of feed is provided by these species, particularly on the heavier soils.

A species of vetch (*Vicia* sp.) introduced into the Maroon district about fifty years ago also appears regularly in the late autumn and provides a good body of feed which is readily eaten by stock. Isolated patches of this plant have been noted in other parts of the district. White clover (*Trifolium repens*) was first grown in the district at Coochin some years ago. It is now well established on parts of the Coochin flats but apparently requires regular topdressing with superphosphate to make maximum growth. Recent attempts to establish several types of clover have not been very successful, though red clover (*Trifolium pratense*) has made good growth in places.

WEED PROBLEMS.

The main weed problems are associated with cultivated fields and include nut grass, noogoora burr, Johnson grass, bell vine, woolly-top Rhodes grass, star thistle and swamp dock.

Nut Grass (*Cyperus rotundus*).—This weed is confined mostly to the alluvial country, though in places it has become established in scrub areas. While remaining a constant menace, it is kept more or less in check by cultivation and careful management. Lucerne planted in the autumn usually has made sufficient growth by the spring to check the growth of the weed. Spring planted potatoes normally are not troubled because cultivation commences before the "nuts" have made much growth. The autumn potato crop is sometimes affected by excessive growth of the pest if wet weather is prolonged after planting. Small patches are usually dug out by hand and carried off and burnt.

Noogoora burr (*Xanthium pungens*).—Seasonal conditions affect the development of this weed, which is worse in some years than in others. Usually it is controlled by mowing, cultivation or chipping, but increased use is now being made of hormone weed killers.

Johnson grass (*Sorghum halepense*).—In some localities this pest has a good hold. Control has sometimes been obtained by intensive cultivation and fallowing, followed by lucerne or some other cover crop. Sodium chlorate weedicides have been used on isolated patches with good results, and the treatment is expensive for large areas.

Bell Vine or Convolvulus (*Ipomaea plebeia*).—This pest is particularly bad in some scrub areas, where it grows prolifically in maize crops in very wet seasons. The only forms of control practised are cultivation, chipping, and rotating maize with cover crops such as cowpea. Bell vine is susceptible to hormone weedicides.

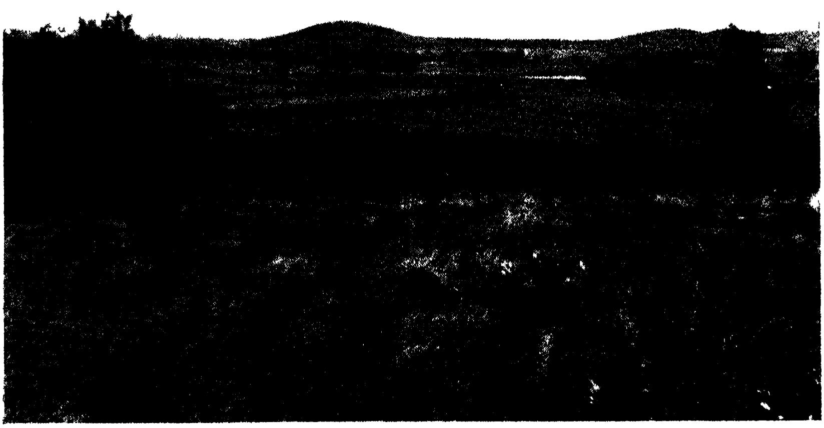


Plate 54.

Alluvial Flats Along Reynolds Creek.—This is an extension of the alluvial country shown in Plate 53.

Woolly-top Rhodes or Feather-top Chloris (*Chloris virgata*).—In alluvial country, woolly-top Rhodes grass often becomes established in declining lucerne stands. Renovation of lucerne paddocks is of considerable assistance in controlling the grass, and topdressing with superphosphate, by keeping the lucerne in active growth, also helps.

Star Thistle (*Centaurea calcitrapa*).—This plant is a new weed which has recently been discovered in lucerne crops in the district. So far it has not spread widely, but is a potential danger.

Swamp Dock (*Rumex brownii*).—This weed has become a common pest of lucerne fields in the last few years. In addition to robbing the lucerne of moisture and plant foods, it also, because of its succulence, makes curing of the hay difficult. Chipping and treating patches with power kerosene are methods used to eradicate the pest.

AGRICULTURAL CROPS.

Potatoes.

The Fassifern district grows an appreciable proportion of the State's crop of potatoes. Practically the entire crop is grown under irrigation along Warrill, Reynolds and Teviot Creeks and to a lesser

extent Burnett Creek. Small areas are grown in the scrub country from Roadvale to Dugandan, but these are non-irrigated and usually do not exceed half an acre in extent. The crop from these plots is used for home consumption and only in good seasons does it add much to the output from the district. In the main producing areas of Aratula, Tarome, Charlwood, Fassifern Valley and Kalbar, the average area is about eight acres, with some growers handling up to 20 acres.

Irrigation from the creeks or wells allows planting to be carried out at the required time without being dependent on rain; all watering is by means of the spray system. Planting times are normally July for the spring crop and February for the autumn crop. Difficulty is sometimes experienced in establishing the autumn crop if wet weather is continuous at planting time. Mid-March is considered to be about the limit for late planting owing to the danger of frost damage. On the other hand, it is not considered advisable to plant later than mid-August for the spring crop, as the later stages of development of the crop will be taking place under conditions of high temperature. Potato crops usually follow lucerne, pumpkins or fodder crops, or are planted following the ploughing-in of a green manurial crop, usually Poona pea. Because of the practice of planting with irrigation, seed for the spring crop is usually cut into fairly small setts so that a planting rate of about four bags per acre is used. Rows are usually placed 27 to 33 inches apart, with plants spaced at 12 to 15 inches in the row. Whole setts are recommended for planting the autumn crop because then there is less risk of rotting under excessively wet conditions. Seed for this latter crop is saved from the spring crop.

In recent years, the use of fertilizers has increased and now most growers use some form of artificial fertilizer for potatoes. Proprietary mixtures containing a high proportion of nitrogen are commonly used with good results. Tests by the Department of Agriculture and Stock have shown that straight sulphate of ammonia gives equally good results. The fertilizer is sown in the drill when planting by hand. Increasing use is being made of mechanical planters, some of which are equipped with fertilizer hoppers.

Factor is the most popular variety and has given excellent results on all farms. Katahdin is probably next in order of popularity, though its tendency to set tubers close to the surface makes it disliked by some growers. The recently introduced Sebago variety appears promising; small areas of Manhattan and Bismarck are also grown.

The handling of the potato crop is highly mechanised in the Fassifern, due chiefly to the fact that an efficient elevator type digger is manufactured in the district. Practically every grower of three acres or more has a mechanical digger of some type. Planters and spray machines for the application of insecticides, of both local and outside manufacture, are also extensively used.

Yields vary with soils and season, but crops of six tons per acre are normally expected on good, well prepared potato land, and 8-10 ton crops are frequently dug.

Lucerne.

Approximately 10,000 acres of this crop are grown and about 75 per cent. of the area is used for grazing dairy cattle or for making hay for consumption on the property. In the scrub areas lucerne fields

rarely exceed five acres in area, and excess growth made during the summer is stored in sheds or stacks. On the alluvial lands larger areas of up to 50 acres or more are grown for hay and chaff. Three pick-up baling machines are now operated in the district and are available for a limited amount of contract work, but most of the hay is cut into chaff. Spray irrigation is used on the crop on Warrill and Reynolds Creeks. Yields vary from 15 cwt. to 30 cwt. per acre and usually average about 18 to 20 cwt.

Maize.

This crop is grown on most farms, but the bulk of approximately 8,000 acres is in the scrub districts. Nearly all the maize grown in the area is used for feeding stock on the growers' own farms and comparatively little is exported.

Yellow Dent strains predominate, but Leaming and Ninety-Day varieties are also favoured. Red maize is not largely grown and there are very few growers of white maize. Hybrid maize is gaining popularity, the strain Q716 having given particularly good results. Yields vary from 24 to 30 bushels per acre in poor seasons to 60 bushels or more under more favourable conditions. Planting may commence as early as July in the elevated scrub areas, but on the alluvial flats August and September are the earliest months for planting. Planting may be continued up to late January but November appears to be the safest month.

Pumpkins.

Both table and cattle types of pumpkins are grown in quantity. On the alluvial country they are grown in rotation with potatoes and irrigated when necessary. In the scrub areas early planting of this crop and other cucurbits sometimes allows the farmer to realise good prices on the market when these vegetables are in short supply.

Grain Sorghum.

Small areas of grain sorghum are grown. Yields of up to 90 bushels have been obtained on good soils and in an average season 60 bushels per acre is a reasonable crop. Wheatland is the variety most widely grown. With the introduction of more headers into the district the area under grain sorghum will probably increase.

Wheat.

The area under this crop has increased over the last few years but probably does not exceed 1,000 acres. Yields as high as 60 bushels per acre have been obtained but the restricted size of properties and the ability to grow more profitable crops limit the expansion of this crop. Warput variety has given good results to date.

Broom Millet.

The area devoted to this crop has declined over the past ten years due mainly to labour shortage. Excellent samples of the crop are still grown, though the Moogerah district is the only one now producing broom millet. The average yield is about 8 cwt. of broom per acre.

Miscellaneous Crops.

Winter and summer fodder crops are grown extensively. Of the former, oats, barley and wheat are the main types, with oats the most widely grown. Field peas are occasionally grown with wheat or oats. Algerian is the most popular variety of oats, while Belah and Buddah are favoured for later sowing.

Summer fodder crops include millets or panicums, Sudan grass and sweet sorghums, the last being the most widely grown. Plantings are made as soon as frost danger is past, and are carried on until the autumn. Cowpeas are used with panicum (millet) or may be planted without any other crop.

Onions are cultivated on a few farms in the irrigated areas, particularly near Harrisville, where one grower has about 20 acres.

HORTICULTURAL CROPS.

Vegetables are grown mostly in the winter on the scrub area from Roadvale to Boonah. Tomatoes are probably the most popular of the small crops and several growers make a specialty of this crop. Marglobe and Break-o-Day are the main varieties. Cauliflowers, cabbages, cucumbers, beetroot and peas are also grown in smaller areas.

With the exception of several isolated patches of bananas, fruit crops are not commercially grown.

Plate 55

View From Mount Alford Towards Boonah, Across Bunjurgen Flats.

DAIRYING AND MIXED FARMING.

Dairying is the main form of agricultural activity in the district. Practically every farm in the scrub areas depends on dairying and pig-raising for its existence. On the alluvial country the proportion of dairy farms is slightly less, as crop growing is the major occupation of some farmers. Approximately 750 suppliers send cream to the Boonah Butter Factory, which is a branch factory operated by the Queensland Farmers' Co-operative Association. At the northern end of the district some cream is despatched to the same Association's factory at Booval, while milk is also supplied for the bottled milk trade in Ipswich. One of the Brisbane bottled milk companies also obtained supplies from this part of the district.

Production of butter at the Boonah factory varies from about 22 tons per week to over 50 tons. The average size of herds is from 20 to 30 head of milkers, with slightly smaller numbers in the scrub districts. A.I.S. and Jerseys are the most popular breeds and there are several good herds of Friesians. Pig-raising combined with dairying is an important industry.

Conservation of fodder, usually in the form of hay (mostly lucerne), is carried out on many farms, while a number of scrub farms are equipped with silos. Shortage of labour has been responsible for a number of silos remaining empty, but a silo-filling unit has recently been organised by a local contractor. This consists of an ensilage harvester and two trucks fitted with extended sides to follow behind the harvester. With this unit available it is hoped that greater use will be made of the present silos and that more silos will be constructed. There are no machinery pools in the district, but a number of contractors are available for ploughing, planting, cultivation and harvesting of all crops normally grown in the district.

GRAZING INDUSTRY.

In spite of the predominance of agriculture and dairying, the grazing industry is active. In the foothills of the Main Dividing and McPherson Ranges are found a number of grazing properties of approximately 5,000 acres. In addition, smaller properties of from 600 to 1,000 acres in area are maintained by farmers as additional areas to their agricultural holdings. These smaller properties each turn off about 50 to 100 head of fat cattle every year. It is estimated that there are about 15,000 to 18,000 head of beef cattle in the district. Carrying capacity of the pastures grazed varies from one beast to ten acres on the poorer ridges to about one beast to four or five acres on the flats.

An interesting departure is the grazing of sheep on a property near Kents Lagoon, Kalbar. The area of 640 acres is composed mainly of poor ridgy country carrying black spear grass. Approximately 100 acres adjacent to the lagoon, mostly heavy clay loam and silty loam, have been sown to lucerne. The sheep are pastured on this for a short time every day in addition to grazing outside. The owner has a property near Richmond, North Queensland, and brings down mobs of about 2,000 head at a time. These are held on the Kalbar property for about six weeks before being marketed in top condition.

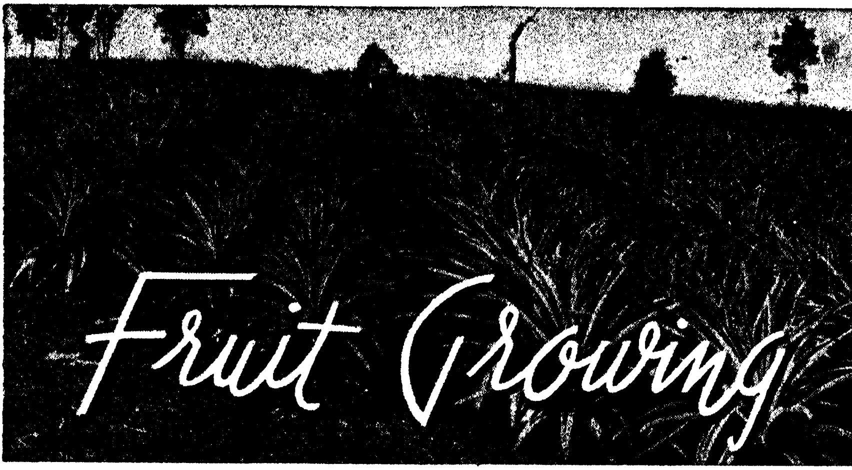
TOBACCO SEED FOR SALE.

The Department of Agriculture and Stock now has fresh stocks of tobacco seed for sale to Queensland farmers.

The following varieties are available:—Cash, Gold Dollar, Virginia Brightleaf, Mammoth Gold, "400", Yellow Special, and Hicks.

Owing to a limited supply of Hicks, no more than one ounce can be supplied to each buyer.

The price of seed is three shillings per ounce cash with order or C.O.D.



Pruning Shy Bearing Grape Vines.

F. A. L. JARDINE.*

SOME varieties of grapes do not set satisfactory crops of fruit. They are regarded by growers as shy bearers which, if grown to any appreciable extent, depress the annual crop output from the vineyard. The quality of the fruit carried by some of these varieties is very good and the market pays high prices for it. However, the area planted is small and is not likely to increase until methods of improving yields are discovered.

In the Stanthorpe district, the two varieties Purple Cornichon and Waltham Cross do not yield well, the former being the worse offender. The fruit of both is excellent and finds a ready sale.

EFFECT OF PRUNING.

Certain varieties of grapes are known to be most fruitful when pruned to one particular system. In Queensland, pruning systems in vineyards have followed current practices in other Australian States and overseas and may not be the best available for local conditions. It was therefore decided to compare three systems of pruning on the Purple Cornichon and Waltham Cross varieties. The two methods of pruning most widely practised at present on these varieties are the Unilateral Cordon system of short pruning and the Bordelaise Espalier method of long pruning. The systems selected for trial were:—

(*a*) Unilateral Cordon short pruning, a system in which the vine is trained to one arm with two canes at each spur. One of these bears the current season's crop and is completely removed in winter; the other is shortened to two buds at the same time (Plate 56).

* Mr. Jardine died in April last at the age of 57. He joined the Department shortly after World War I., in which he served with the 5th Light Horse Regiment, and was engaged in advisory and experimental work in Queensland orchards and vineyards up to the time of his death. The numerous articles on grape growing published in this journal by the late Mr. Jardine indicate the special interest which he took in the crop, and Queensland viticulturists in particular will feel the loss of this experienced and enthusiastic officer.

Plate 56.
Unilateral Cordon Short Pruning.

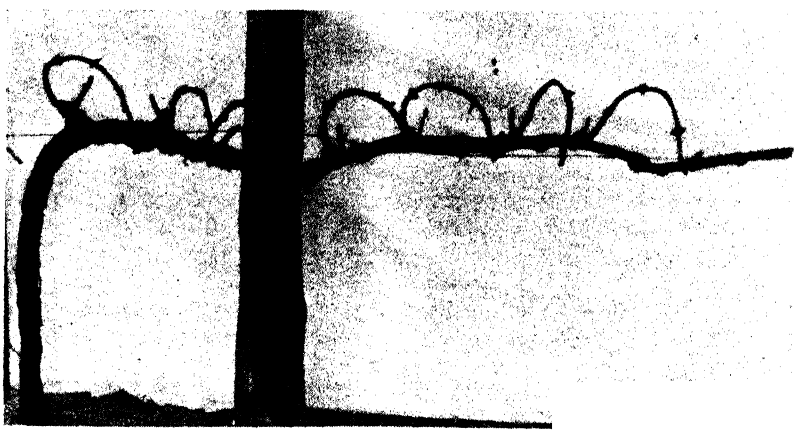


Plate 57.
Casanave Cordon Long Pruning.

(*b*) Casanave Cordon long pruning, in which the vine is trained as a Unilateral Cordon until the spurs are established. The upper of the two canes at each spur is then pruned to a rod of five or six buds and tied down to the main arm; the lower cane is cut back to two buds (Plate 57).

(*c*) Bordelaise Espalier long pruning, which is suited to over-vigorous vines. A short spur is retained on each side at the top of the main stem. The upper cane at the spur is cut to a rod of four or five buds and tied to the bottom wire as a bow. The lower is cut to two buds and supplies the spur wood for the following season (Plate 58).

The trial commenced at Stanthorpe in 1945 and continued for a period of four years. Yields were taken in summer, and each winter both the weight of the prunings and the lengths of the canes removed were recorded.

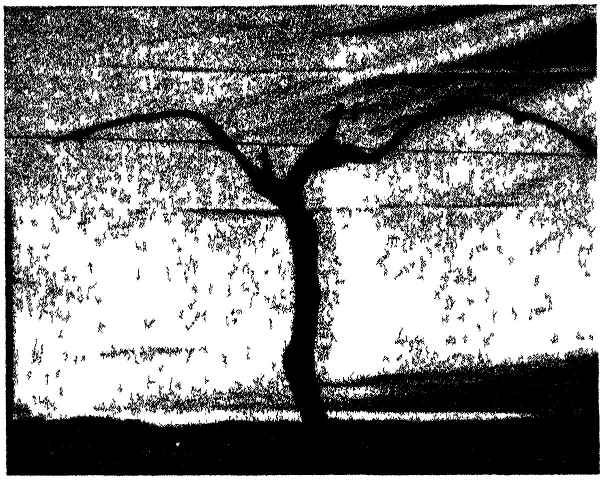


Plate 58.
Bordelaise Espalier Long Pruning.

Results.

The crop yields and growth data are summarised in Tables 1 and 2.

TABLE 1.
EFFECT OF PRUNING METHODS ON YIELD—CASES PER ACRE.

Method of Pruning.	Waltham Cross.				Purple Cornichon.			
	1946.	1947.	1948.	1949.	1946.	1947.	1948.	1949.
Short Pruning (Unilateral Cordon)	446	*	898	128†	606	479	679	59†
Long Pruning (Casanave Cordon)	1,004	*	982	159†	740	598	811	40†
Long Pruning (Bordelaise Espalier)	878	*	749	140†	769	463	620	36†

* Crop completely ruined by grey mould.
† Vines severely damaged by late frosts in September. 1948.

TABLE 2.
EFFECT OF PRUNING METHODS ON PLANT VIGOUR (GROWTH PER VINE IN INCHES.*)

Method of Pruning.	Waltham Cross.			Purple Cornichon.		
	1946.	1947.	1948.	1946.	1947.	1948.
Short Pruning (Unilateral Cordon)	1,410	1,751	1,678	1,032	750	701
Long Pruning (Casanave Cordon)	1,289	1,395	1,648	1,023	740	689
Long Pruning (Bordelaise Espalier)	855	805	1,139	894	617	644

* Recorded at each pruning period in winter.

Yields.

The yield data reflect two of the hazards associated with grape growing in the Granite Belt. In 1947 excessive rain during the later stages of bunch maturity coincided with a severe outbreak of grey mould. In the Waltham Cross variety the wastage reached such proportions that little or no fruit was harvested from the vines. The Purple Cornichon vines suffered less, but the harvested crop was much below normal.

In 1949 late spring frosts occurred when the vines were in full growth. Though repruned to dormant eyes as soon as the full extent of the damage to the canes was apparent, only a very light crop set and the crop harvested in 1949 was extremely small. The yields in 1947 and 1949 are therefore of little value for comparative purposes. However, two points may be inferred from the records. Firstly, Waltham Cross yields more heavily than Purple Cornichon regardless of the pruning system used. Secondly, the Casanave Cordon system of long pruning seems more suitable for both varieties than the two alternative systems at present practised, namely Unilateral Cordon short pruning and Bordelaise Espalier long pruning.

Vigour.

Any loss of vigour associated with faulty pruning methods would be reflected by a drop in both the length and weight of the prunings during the later part of the experimental period. No such drop is apparent in 1947 and 1948, by which time the vines had been trained and the annual treatment stabilised.

RECOMMENDATIONS.

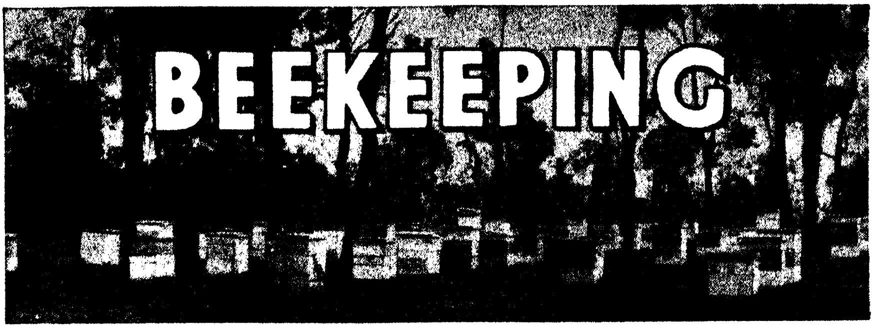
It would be premature to draw final conclusions from a grape vine pruning project extending over only a few seasons, and more detailed work is now in hand. However, the data already available suggest that both the Waltham Cross and Purple Cornichon varieties should be pruned to the Casanave Cordon system. The method certainly deserves a trial in vineyards containing any considerable number of vines of these varieties.

Further, the yields obtained from the Waltham Cross variety indicate that further plantings should be worthwhile in the Stanthorpe district; grower returns should be satisfactory.

CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.



European Foul Brood of Bees.

C. R. ROFF, Apiary Inspector.

EUROPEAN foul brood, an infectious disease of bees, was found for the first time in Queensland in one hive of an apiary near Warwick during April of this year. The disease has caused heavy losses, particularly amongst black bees, in other parts of the world.

The disease is caused by a bacterium (*Bacillus alvei*) which infects young larvae of all three castes. The infection may cause a serious reduction in the number of workers emerging from the combs, with consequent decline or death of the colony. Nurse bees play an important part in spreading European foul brood within the hive. In a dearth period, the juices of dead infected larvae are sucked up by the nurse bees and incorporated with food, which is then fed to other larvae. The practice of equalising colonies by exchanging brood combs spreads the disease within the apiary. Robber bees, by taking new honey placed in cells which recently contained diseased larvae, are also responsible for hive-to-hive infections. Contaminated honey after storage for three months has not proved a fruitful source of infection. Overseas experience indicates that the disease is unlikely to be transmitted by equipment such as hives and tools or by the clothes or hands of the beekeeper unless infected honey is directly robbed from such sources.

Features of the Disease.

European foul brood is essentially a disease of weak colonies of common black and hybrid bees. Italian bees are seldom affected, and this is one of the reasons for the early popularity of this race.

Brood is likely to be infected during any season of the year. However, the severity of the disease in a colony is governed to some extent by the quantity of food available. In regions where the main honey flow is experienced during spring or early summer, European foul brood causes practically no losses. A honey flow supplying nectar continuously tends to hasten recovery of infected colonies; the bees are more vigorous and will quickly remove diseased material from the hive. In colonies where self-recovery has apparently taken place, re-appearance of the disease the following year often occurs, and in the meantime spread to other colonies is likely.

Infected honey is not injurious to humans.

Symptoms.

In diagnosing the disease the following points should be checked before coming to the conclusion that European foul brood is present. It is obvious that a newly infected colony will not exhibit all the points enumerated.

1. The colony is noticeably weak.

2. Decaying larvae and scales are removed by the bees, with the result that a frame of brood assumes a speckled or mottled appearance, due to the presence of empty cells. This irregular appearance becomes more pronounced as the disease develops.

3. This disease is essentially one of unsealed brood, the majority of larvae dying usually within five days after hatching from the egg. Occasionally some larvae survive until the cells are sealed. Sunken and perforated cappings may be observed, but this is by no means common.

4. Instead of remaining in the normal coiled positions typical of young healthy larvae, those infected become restless, move about inside the cells, and occupy a variety of unnatural positions. The irregularity of the positions of larvae is an important symptom.

5. The plump glistening appearance of healthy brood disappears. The earliest noticeable change in diseased larvae is a slight yellowish or yellowish-grey discolouration accompanied by the collapse of the larvae. At this stage larvae are translucent and watery, before becoming pasty and sticky or porridge like. Occasionally decayed material may rope; the thread of the material that ropes out is coarse and lumpy in consistency. Finally, diseased material dries into a yellowish, greyish or nearly brownish-black scale. A very distinct characteristic of this disease is the lack of adhesiveness of the decomposing material, especially of the scale to the cell wall. This feature enables strong colonies to remove the diseased material from the cell.

6. The odour of diseased material may be slightly sour or yeasty, or the material may develop a repulsive carrion odour.

Preventive Measures.

If the following measures are carried out very little loss will be incurred from European foul brood.

1. Introduce a hardy strain of the Italian race of bees.

2. Requeen at least every two years.

3. Maintain colony strength by providing the food, hive space and protection required for each particular period of the year.

Treatment of Infected Colonies

Several methods of treating the disease are practised overseas where the disease is firmly established. Where the disease is widespread, methods adopted are those of minimisation and not of eradication. In Queensland, effective eradication is desired. The present negligible losses caused by this policy are justified in view of the substantial losses that would be suffered by the industry generally if the disease became established.

Diseased hives should be handled in the following manner, which is the safest and most economical:—

1. The destruction of diseased colonies should take place in the evening when all the bees are in the hives.

2. Dig a pit of a size suitable for the number of colonies to be destroyed.

3. Kill all bees in the diseased hives with calcium cyanide; about two teaspoonfuls of the poisonous powder should be put through the entrance of each hive before closing it. *Extreme care should be taken to avoid inhaling the poisonous gas given off by the cyanide.* If calcium cyanide is not readily available, the hive entrance should be closed, a pint of petrol sprinkled over the top frames, and the top cover replaced.

4. Build a fire in the pit, and as soon as it is burning well, add the dead bees and combs. The only parts of the hives not to be burnt are the bottom boards, the hive bodies of the brood nests, the bodies of the extracting supers, and the top covers.

5. Scrape the inside surfaces of the unburnt parts of the hives and burn the debris.

6. After all diseased material has been burnt, spade the ground down, refill the pit, and pack well.

7. Sterilize the undestroyed, contaminated hives and hive parts by either boiling for half an hour in 1 per cent. caustic soda solution or scorching to a dark-brown colour with a blow torch all the inner surfaces and edges.

Legislative Requirements.

Under *The Apiaries Act of* 1947 it is provided that any beekeeper in whose apiary any disease appears shall immediately notify, in writing, the Under Secretary, Department of Agriculture and Stock, Brisbane.

Irrespective of the legal requirements, any beekeeper who notices unusual brood symptoms in his apiary should, for his own sake, communicate with the Department in order that assistance may be rendered in treating the infection.

OPEN SEASON FOR WILD DUCK AND QUAIL.

An Order in Council has been issued declaring open seasons for wild duck (except Burdekin duck) and quail in various districts.

In District No. 1 (which includes the Pastoral Districts of Moreton, Darling Downs, Wide Bay, Burnett, Maranoa, Warrego, Gregory South, and that portion of Leichhardt south of latitude 25), an open season has been declared for the period August 1st to September 30th, 1950. There will be no open season for quail in this district.

In the rest of Queensland, an open season for both duck and quail has been fixed for three months, from August 1st to October 31st, 1950.

No person may take more than 20 wild ducks and 25 quail during a period of 24 hours.

Wool and Its Classing.

C. J. PAYNE, Senior Wool Classer, Sheep and Wool Branch.

IN Australia wool is sold by auction, and the object of classing is to present the clip in a form which will will be most attractive to the buyers and which will assure maximum competition at the sales. As quality in its widest sense, staple length, tensile strength, colour and condition are the main characters influencing the way in which the wool will be utilised, due regard must be paid to them in deciding upon the class in which any fleece will be put.

Buyers prefer "bulk" (five bales and over) to star lots (under five bales) and accordingly it is advisable, when classing a clip, to make as few lines as possible. If a buyer can fulfil an order from one line the manufacturer is assured of raw material which is uniform in quality as well as containing a comparable amount of dust, seed and burr. As similar wools require the same treatment in manufacture, this is a distinct advantage.

If the wool is badly classed and contains fleeces of various staple lengths and of different colours, handle and condition, the buyer has no option other than to value the whole line according to the quality of the worst wool it contains. Because of the amount of work in re-sorting, a badly classed line might be passed over as an uneven lot, and is not likely to command a reasonable price.

SKIRTING.

After the wool is shorn, the shed hands pick up the fleeces and throw them out on the wool tables. Picking up and throwing the fleece is an important operation, as badly spread fleeces are hard to skirt, either too much or too little wool being removed. The picker-up should take hold of a "breech" in each hand, lift them up and draw them around the fleece. It is then thrown out on the rolling table, with tip upwards and neck forward.

The edges of the fleece usually contain most of the burr and seed, and the fatty ends and stained pieces which result from the accumulation of wax under the front legs and from urine stain. These are separated while the fleece lies on the table, and this process is known as skirting

(Plates 59-61). If the fleeces are free from seed and burr, only the fatty ends and stains have to be removed. If burr and seed are spread extensively through the fleece, they are ignored, and fatty ends and stains alone are removed. Excessively heavy skirting would spoil the bulk of the fleece, and the seeds and burrs can be removed during manufacturing by a process known as carbonising.

Plate 59.
Commencement of Skirting.

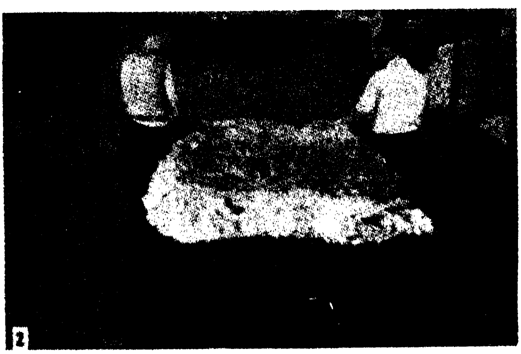


Plate 60.
Shoulder Wool Turned In.

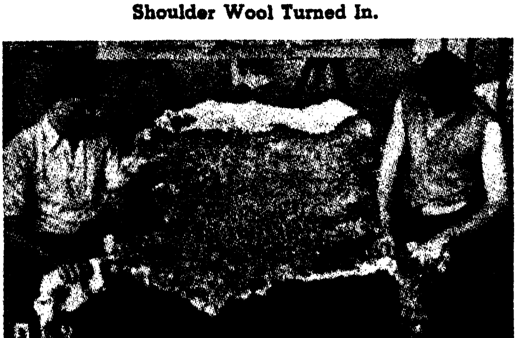


Plate 61.
Skirting the Breech End.

Rough breeches should be skirted off all fleeces, whether seedy or burry.

CLASSING MERINO WOOL.

After the skirtings have been removed from the fleece, the neck wool is thrown in and the two sides are folded across. The fleece is then rolled into a ball, from breech to neck, with the cut end out and leaving the shoulder wool showing (Plates 62-66). The fleeces are then presented to the classer, who classifies them and puts them in their appropriate bins.

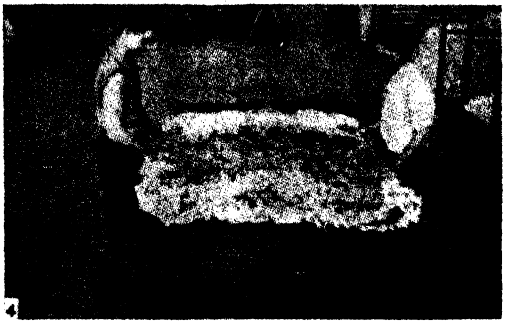


Plate 62.
Commencement of Rolling.

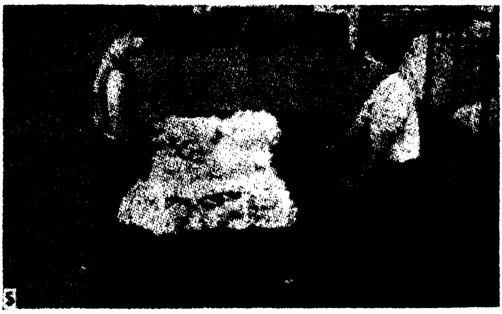


Plate 63.
Second Movement in Rolling.—The fleece has been folded once.

Plate 64.
Fleece Folded the Second Time in the Same Direction and Rolling Commenced from the Breech End.

Plate 65.

Rolling Completed, Exposing to View Rib and Shoulder Wools.

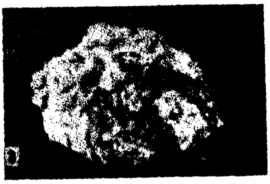


Plate 66.

Fleece Incorrectly Rolled and Showing Unattractive Portions of Fleece.

When classing Merino wool the most important features to consider are staple length, quality, tensile strength, colour and condition.

Staple Length.

Staple length determines whether the wool is suitable for the worsted or the woollen trades. The longer stapled wools go into worsted, while the shorter wools can be utilised for woollen manufacture. The staple length of Merino wool may vary from 1½ inches to 4 inches, but wools which are excessively long, through being overgrown, are at a disadvantage in manufacture because special machinery is required to handle them. English or Bradford combs can handle wool from 2½ inches to 4 inches in length, while wools as short as 1½ inches may be processed on French combs.

Quality.

Quality in Merino wool connotes count in relation to handle. The number of crimps per inch is usually accepted by the trade as a reasonable guide to the count, and therefore as being indicative of the number of hanks of yarn which can be spun from one pound of clean scoured tops. One hank contains 560 yards of yarn and up to 80 hanks might be made from one pound of clean scoured tops produced from fine Merino wool. Such a wool is referred to as 80 count, or as an 80's Merino. If only 60 hanks of yarn could be spun from a pound of clean scoured tops, the wool would be classed as a 60's. The usual range of counts in Merino wool is from 60's to 80's, though some are finer and a few may be coarser, or stronger, as they are called. The range of counts is shown in Plates 67-69, and a fine Merino fleece in Plate 70.

Handle is an important characteristic of all wools, which should be soft, but full. Wools which combine soft handle with fine fibre diameter are in demand by the manufacturer. Those which are harsh in handle and coarse in fibre diameter are not so popular, though soft handling, medium to strong wools are always in demand.

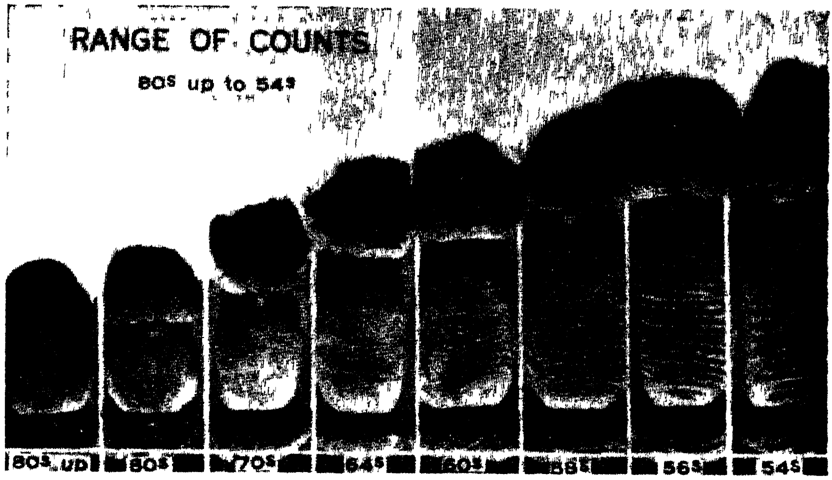


Plate 67.

Wool Samples Showing Counts from 80's to 54's.

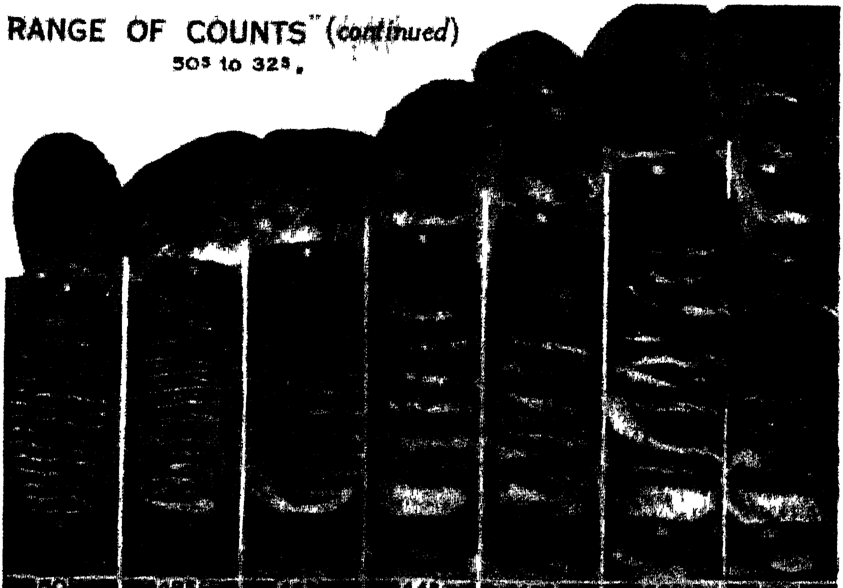


Plate 68

Wool Samples Showing Counts from 50's to 32's.

[*Illustrations for Plates 59-68 are from a booklet of the Victorian Department of Agriculture.*]

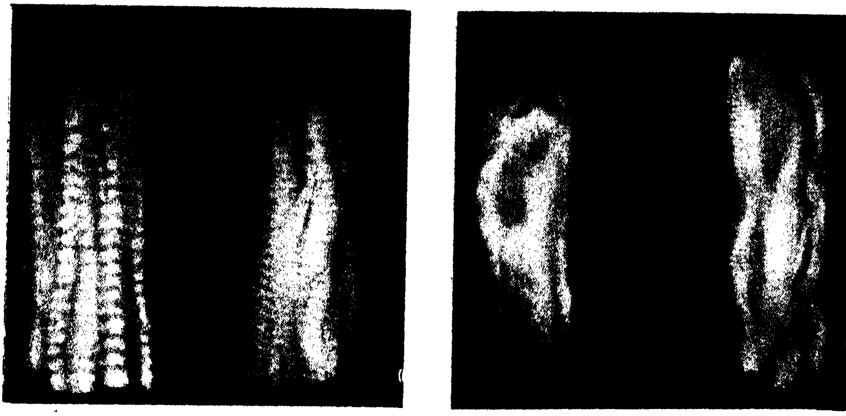


Plate 69.

Merino Wool Samples.—From left—strong (60's); medium (64's); fine (70's); superfine (80's).

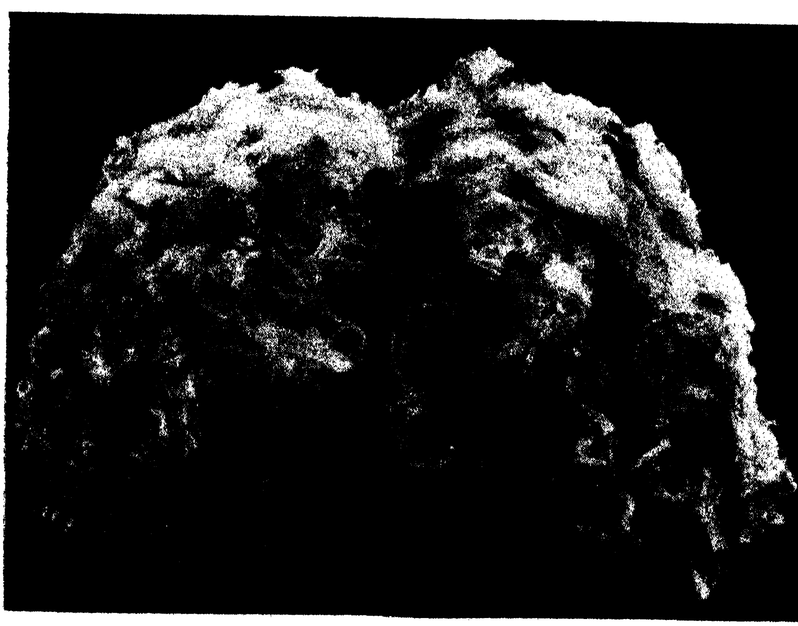


Plate 70.

A Fine Merino Fleece.

Tensile Strength.

Tensile strength is also referred to as soundness, and it is an important quality in all wools. Unsound or tender wools break frequently during manufacture and they produce a large amount of noil. Long stapled wools may become, in effect, short stapled ones if they have a "break" at about the centre of the staple, and may have to be handled as short stapled wools during manufacture.

Colour.

Bright wools which will be white after scouring are ideal. Dull, heavy coloured wools will not dye so well, and even after dyeing they do not reflect the light to the same degree.

Condition.

Condition refers to the amount of yolk, dust, earth, burr or seed contained in the wool. As wools are bought on a calculated clean scoured basis, a high percentage of foreign matter will decrease the yield and lower the price.

Lines of Fleece.

Supposing a grower shears 2,000 to 5,000 Merinos, the following lines could be made:—AAA, AA, A, FLEECE (cast line), A1 (long and strong), COMBING (short and strong).

AAA.—AAA would comprise wool of good combing length (2½-4 in.) and good colour, sound and light in condition, and of a good medium to fine quality.

AA.—AA is wool of combing length (but not as long as AAA), sound, of fair to good colour, and of medium to fine quality.

A.—A will consist of medium to short wools (carding type), of good colour and condition, and medium to fine in quality.

These two classes—AA and A—are the medium to fine wools.

Fleece.—The fleece line would be termed the cast line and may be somewhat irregular in length. It would contain the dull, heavy, shabby and unattractive fleeces.

A1.—A1 is strong wool of a 60's spinning count, of good combing length, sound and bright in colour, and medium to light in condition.

Combing.—Combing comprises the short strong wools which are not of a combing type. They are dull in colour, and heavy in condition. Any wools of a doggy nature should be kept out of this line and baled separately.

Tender Wools.—Tender wools, appearing in small quantities, should be kept out of all combing lines and placed in lines containing wools of shorter length but of comparable colour and condition to these lines.

When tender wool appears in large quantities, it must be kept separate from sound wools, and classed on similar lines. The length of staple will be determined from where the break occurs.

Merino Skirtings.

The skirtings receive special treatment. They are usually "picked" into two or three lines, comprising "Broken," 1st and 2nd Pieces; or Pieces and Stained Pieces.

Broken.—Broken (Plate 71) includes the bulk of the skirtings. They are wools of good length and colour, fairly light in condition, and with the rough edges, fatty ends and stains removed.

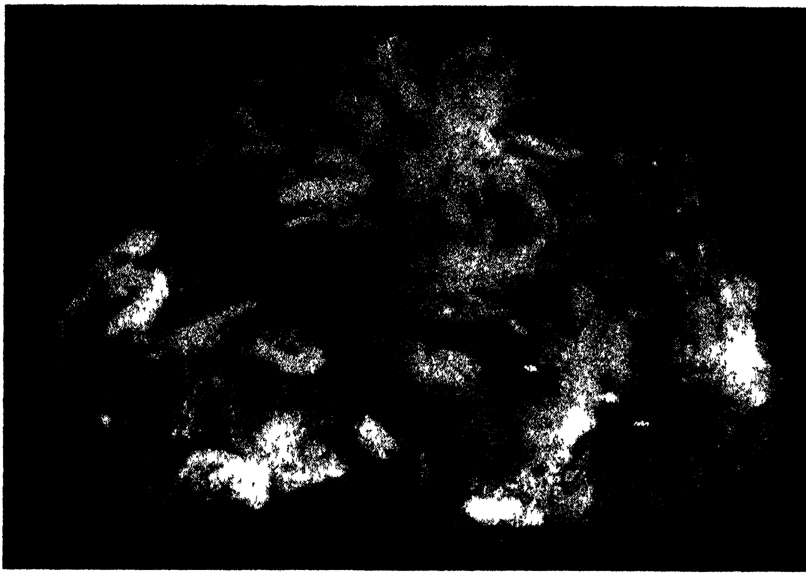


Plate 71.
A Sample of "Broken" Wool.

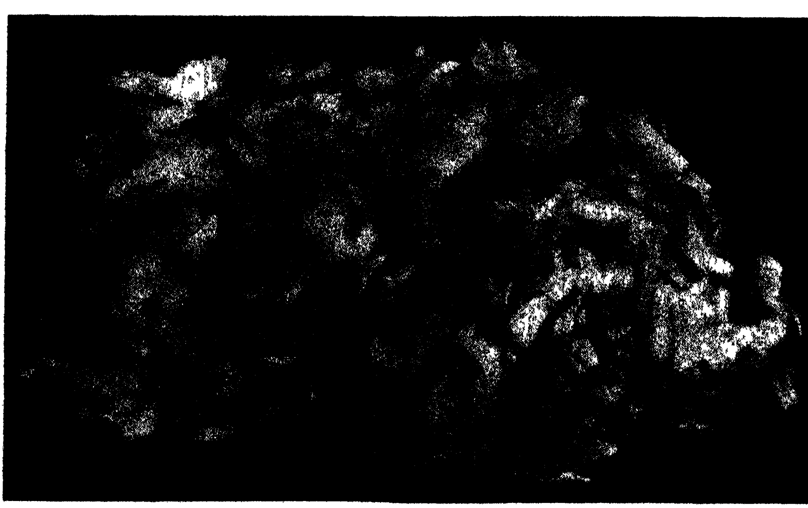


Plate 72.
1st Pieces.

Pieces.—Pieces (Plates 72 and 73) would not be as bulky as the broken, but are of fair to good length. They are heavier in condition, duller in colour, free from stains, and with the worst of the fatty ends skirted off.

Plate 73.
Pieces.

Plate 74.
Stained Pieces.

Stained Pieces.—If a large amount of the wool from the crutch or pizzle carries urine stain, it may be sorted into a second line, which is referred to as the second or stained pieces (Plate 74).

Bellies and Locks.

Bellies—Pizzle stains and fatty ends are removed from bellies (Plate 75)

Locks—Locks (Plate 76) are the short pieces from the shearing boards as well as the wool which falls through the spokes of the wool rolling, piece picking and classing tables

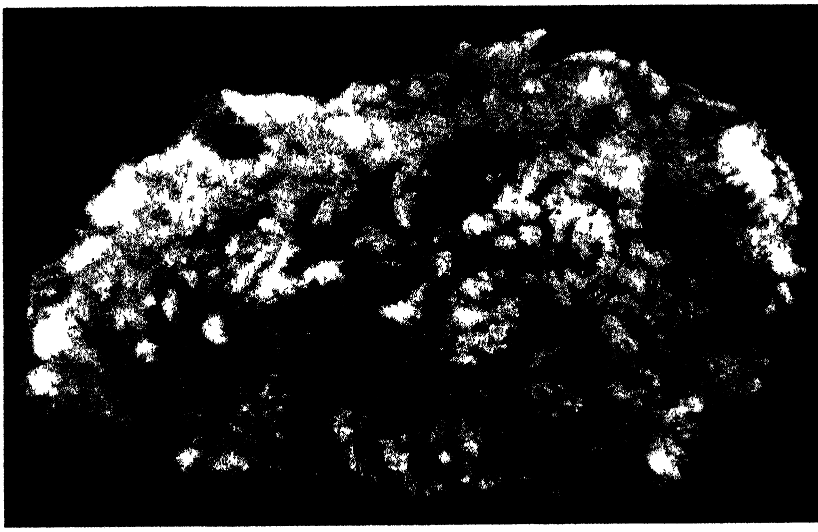


Plate 75
Bellies

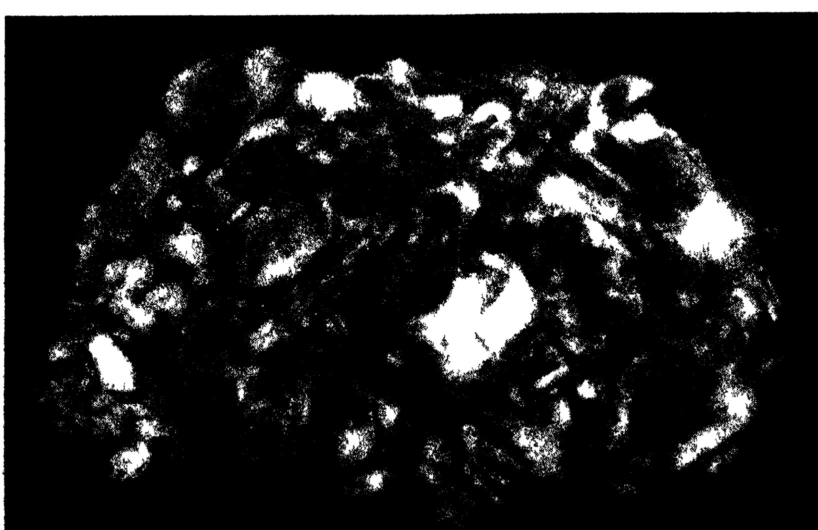


Plate 76.
Locks.

CLASSING CROSSBRED CLIPS.

Quality within the range of spinning counts is the most important factor taken into consideration in classing crossbred clips. Crossbred fleeces are more variable in quality and condition than Merino.

In classing a clip of crossbred wool from a flock numbering from 2,000 to 5,000 sheep whose spinning counts range in quality from 36's to 60's comeback, the following lines could be made, provided there are sufficient wools of 58/60 spinning counts shown in the clip.

AAA CBK.—This would include wool of 58/60 spinning count, good combing length, light in condition, sound, and of a good colour.

AA CBK.—This line would comprise wool of shorter CBK lengths, of the same spinning count, but duller and heavier in condition; any odd tender CBK fleeces may be placed in this line.

Plate 77

Corriedale 56's (left); **Romney Marsh 44's to 46's** (right).

AAA XBD.—This class would contain fine wool of a 50's-56's quality, of good colour and condition, sound, and even in length.

AA XBD.—Included here are medium quality wools of 46's-48's spinning count which have the same features as AAA XBD. It must be sound, even in length, and with good colour and condition.

A XBD—This line contains all strong fleeces ranging in quality from 40's-44's spinning count.

Strong fleeces with spinning counts less than 40's should be baled separately and branded L. FLEECE Any unattractive, badly discoloured fleeces, or odd tender fleeces, should be kept out of the above lines and a cast line made as in Merino. This line will be irregular in length, quality and condition, and the line could be branded FLEECE.

When XBD clips range in quality from 36's to 50's spinning count, the same lines would be made as in qualities ranging from 36's to 60's, but there would be no CBK lines The same features of length, colour and condition would prevail

Plate 78.

Border Leicester 44's to 46's (left); **Doggy** (centre); **Leicester 40's** (right).

AAA XBD.—This line would consist of wool with a count of 46's-50's.

AA XBD—This includes wool with a count of 40's-44's.

A XBD.—This is wool with a 36's spinning count and fleeces too rough for AA XBD.

The skirtings from an XBD clip should be treated similarly to those from a Merino clip.

Breeches often run very strong in XBD clips. It is advisable to keep these separate from broken and pieces and place them in a line of their own. They could be branded A, Pcs. XBD.

All ram fleeces from Merino and XBD clips should be skirted lightly and baled separately. Because of their distinctive smell, they need severe treatment in scouring.

WOOL PRESSING.

A great deal of damage may be done to any clip if the wool room is dusty and untidy, as the wool may be contaminated by string, dirt or other foreign matters which will depreciate its value. It is advisable to see that the wool room and bins are swept clean before shearing commences. The press should be overhauled, screws tightened, and all joints and pulleys oiled.

If packs have to be cut down to fit the bottom box, the work should be performed some distance from the wool press, as the loose cut twine may get into the wool. This interferes with the combing and dyeing processes.

Packs should be placed in the press with the sewn seams facing the fixed side. The sewn seams are those which run along both sides and the bottom of the pack. The fleeces should be placed in the press as carefully as possible, and the bottom box tramped tightly, taking care that the four corners are well filled. This will ensure a neat bale. If necessary, the corners should be neatly sewn. No less than four bale fasteners should then be placed firmly through both flaps and cap.

BALE BRANDING.

The bales should be branded distinctly with the name of the property, the quality or class of wool, the sex mark and the number of the bale. These four marks should be placed directly beneath one another (as shown below) on the square or narrow side of the bale—that is, the side that has been stitched across the bottom.

Kincraig.
AAA
E
159

Prospective buyers will look for neatly pressed and branded bales, as these will usually contain more carefully classed wool. In addition, evenly filled and well pressed bales are easier to handle and transport.

Agricultural Chemistry

Contour Furrowing of Claypans.

C. R. VON STIEGLITZ, Officer in Charge, Plant Nutrition Section.

FOR some years past, Mr. G. W. McIlroy, General Manager of Comongin Proprietary Limited, has been carrying out experiments on a grazing property near Quilpie, with a view to reclaiming claypan country, and the writer was privileged recently to see the results of this enterprise.

Method of Treatment.

The method of treatment is simple, the cost low, and the results outstanding. The method consists of ploughing a number of furrows on the contour with a twin-disc plough, and then running a Britstand grader along the edge of the furrow to form a better bank to hold back the water. The type of country that is being treated is shown in Plates 79 and 80; it will be noticed that the land is bare of vegetation despite the fact that seasonal conditions had been extremely good.

The water which can be seen lying in the furrows had accumulated from 72 points of rain in two falls about the same period. The last fall was four days prior to the time of inspection. The land generally has a very slight slope, and contours, spaced about a chain apart, have a half-inch vertical interval. The levels are carefully taken by means of a dumpy level. In slightly flatter areas, where the surveyed furrows are spaced at greater horizontal intervals, an additional furrow is put in by eye.

Trapping of Moisture.

The first effect of the furrowing, the trapping of the water so necessary with this type of soil, is shown clearly in Plates 79 and 80 (If these are examined closely it will be noticed that the surface of the soil appears to be covered with small pebbles. This is not so, however; the surface covering is in fact small curled-up pieces of silt which have taken this shape on drying.) Trapping of the water in the furrows has resulted in water being held temporarily in the space between the furrows. Normally it runs off immediately.

The next stage in the reclamation is the gradual establishment of herbage in and near the contour furrows. Finally the herbage occurs over the whole area. The type of herbage to appear first is comprised of wire burr, soda bush and red top burr. These plants have the effect of gradually accumulating fine wind-blown soil material on the polished claypan surface. This layer of dust serves as a seed-bed and allows grass to germinate and gradually displace the rough herbage. Plates 81 and 82 show an area that was furrowed in March, 1949. In Plate 82,

Plate 79

Claypan Area Recently Furrowed on the Contour.—Note the surface covering of curled pieces of silt between the furrows

Plate 80

A Recently Furrowed Claypan.—The furrows contain water from rain which fell a few days previously

which is a close view of the surface, it will be noted that the soil is cracking and the structure coming back. The recently treated area, shown in Plate 79, has a hard polished surface.

Plate 83 shows an area that was contour furrowed 4½ years ago. The contrast between the treated area carrying grass and the untreated area in the immediate foreground, showing rough herbage, is most

Plate 81

A Furrowed Claypan Photographed a Few Months After Treatment.—At this stage the vegetation is composed mainly of herbage, with little grass Abnormally high rainfall was experienced after the furrows were made

Plate 82

A Close View of Portion of the Claypan Shown in Plate 81.—Note the cracking, which indicates some improvement in soil structure.

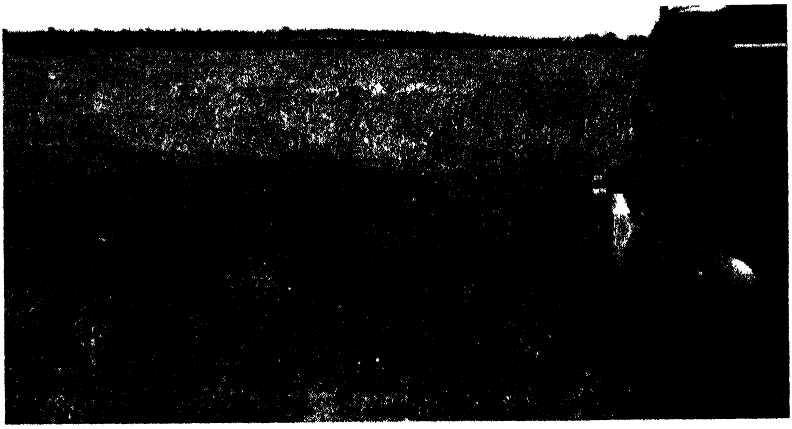


Plate 83.

A Well Grassed Claypan 4½ Years After Furrowing.—The section in the foreground, carrying rough herbage, was not treated.

marked. It is Mr McIlroy's opinion that this area in the foreground would have been devoid of vegetation but for the fact that the season has been an exceptionally good one.

Effect on Salt in Soil.

Soil samples were taken from the areas treated in October, 1949, and in the spring of 1944, respectively, and the field descriptions, as well as the figures for pH (acidity index) and salt, are given below.

Recently furrowed area—		pH	Salt as NaCl Per cent.
0″–16″	Fine yellow-red silty clay loam—structureless	7·5	0·257
8″–16″	Fine yellow-red silty clay	6·5	0·020
16″–18″	Fine yellow-red silty clay	6·1	0·252

Area furrowed in 1944, now covered with grass—		pH	Salt as NaCl Per cent.
0″–8″	Yellow red silty clay—nutty structure	6·2	0·003
8″–16″	Yellow red silty clay—massive	7·0	0·322
16″–24″	Yellow red silty clay—massive	6·7	0·193
24″–30″	Grey red silty clay—massive	6·9	0·495

In the case of the newly furrowed area, the soil was so dry at 20 inches that it would not remain in the auger, but that from the area covered with grass was moist to about two feet and no great difficulty was experienced in obtaining samples to 30 inches.

The distribution of chlorides, estimated as common salt, through the soil, is illustrated in Plate 84. It will be noted that recently furrowed areas show a high concentration of salt in the surface soil, while in the areas which were furrowed several years previously only a trace of salt is found when the surface soil is sampled to a depth of eight inches.

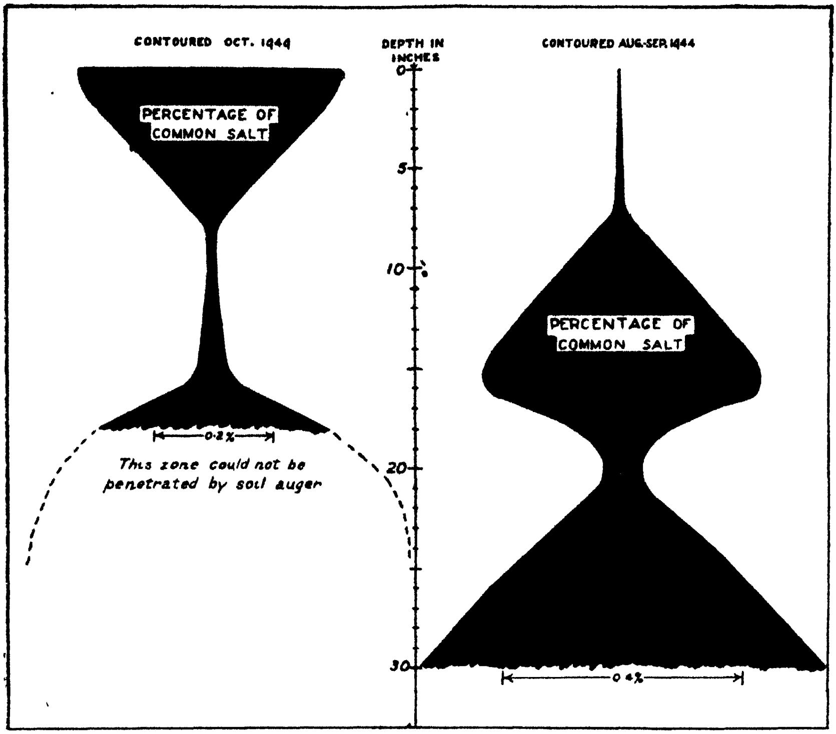


Plate 84.

Salt Concentration in Claypan Soils.—This diagram shows how contour furrowing has caused the leaching of soluble salts (calculated as common salt) from the top few inches of soil. Most plant die when the salt concentration reaches 0.3 per cent., while many are adversely affected at 0.1 per cent.

On recently treated claypans the surface soil is so high in salt that only plants which are salt tolerant are able to germinate and flourish. The presence of these plants helps to reduce the salt content of the surface soil, firstly by lowering the evaporative rate and secondly by improving the soil structure, thus enabling the water to penetrate to the subsoil. The amount of moisture which reaches the subsoil of undisturbed claypans by vertical penetration is negligible even in seasons of relatively heavy rainfall. Once water begins to move down into the lower horizons of the soil the soluble salts are carried with it. After a few seasons so much salt has been removed from the surface that plants which are much less salt tolerant than those which grow in the first year begin to establish themselves.

The high concentration of salt in the surface soil prior to any treatment is due mainly to the high rate of evaporation. In south-western Queensland, the evaporation from a free water surface is several times greater than the rainfall. Thus, wherever there are conditions which result in water, whether it be fresh, rain water or run-off from another area, remaining on the surface for some time, the volume is reduced by evaporation. Consequently, water which originally had no adverse effect on plant growth soon reaches a stage at which the salt

content is high enough to kill many plants. This procedure, repeated over a period of many years, results in the concentration of salt in the surface soil reaching a point at which even native salt tolerant plants are unable to grow. This may happen even when the water remaining on the surface at any particular time does not reach a concentration sufficient to have an immediate harmful effect on the vegetation.

This concentration effect will continue as long as the water is unable to penetrate far enough into the soil to carry the soluble salts below the root zone. Where claypans are formed amongst sandhills, a certain amount of salt also moves out from the lower slopes of the dunes in the same way as the clay, which is washed down and moves laterally to form a claypan.

Increasing Moisture Penetration.

As the chief factor in successful reclamation appears to depend on moisture penetration, it is thought that the use of a spike roller, similar in principle to that used on bowling greens for overcoming a drummy or crusty surface effect, would be beneficial in hastening the growth of herbage and grass. Such an implement should have the effect of trapping moisture wherever the spikes penetrate in the same way as do the furrows under the present system, and this should ensure seed germination uniformly over the area.

It is suggested that the use of 4-inch steel spikes on a cylinder about 12 inches in diameter and 6 feet in width would be well worth a trial. This could be drawn over the area between furrows immediately after their completion.

APPLIED BOTANY

Poisonous Properties of African Star Grass.

Contribution No. 16 of the Queensland Poison Plants Committee.

A FEW years ago, samples of African star grass were examined in the Chemical Laboratory of the Department of Agriculture and Stock for prussic acid content. Since then, observations on the grazing of this grass by stock have been made, and the following information on the grass and its poisonous properties is now presented.

Names.

African star grass is known also as budgee grass, giant star grass, and giant couch. The last name is also used commonly for Para grass. The botanical name of African star grass is *Cynodon plectostachyus* (K. Schum.) Pilger.

Description.

Perennial grass with numerous prostrate hard stems, spreading widely and rooting at the joints; tufts of leaves and stems arising at each joint and sometimes sending up long slender seed stalks; leaf sheaths flattened, leaf blades bright green, spreading, 2-5 inches long, $\frac{1}{8}$ in. to $\frac{1}{6}$ in. broad, tapering gradually from the base to a fine tip; seedheads consisting of several branches spreading star-like from the top of a stalk 6 in.-15 in. long, each branch with numerous "seeds" (spikelets) closely packed in two rows along the lower side.

Distribution.

African star grass is a native of Africa introduced some years ago as a possible fodder grass. The plant is now found in a number of localities widely spread over the State from the Atherton Tableland to the southern border and in some enclosed areas as far west as Barcaldine.

Seasonal Occurrences.

Though the grass is a perennial, it makes most of its growth in the warm weather following spring or summer rains. It dries off during the winter but never becomes completely leafless.

Poisonous Properties.

(*a*) Field Evidence.—On only two occasions has trouble been reported with this grass in Queensland. In one case a cow was found dead after it had been on the grass for about 24 hours. The paddock had not been grazed for three months and the grass was very green and succulent because of an abnormally wet season. In the other case 10 cows grazing on the grass showed symptoms of poisoning. They were drenched with photographic hypo (sodium thiosulphate) and recovered.

(*b*) Chemical.—Table 1 indicates that African star grass grown near Brisbane can produce a prussic acid level up to three times as high as that usually regarded as the danger level (20 milligrams prussic acid per cent., or 200 parts per million). The only figure from a low rainfall area (specimen from Blackall) is above the level and a specimen of old growth from Rockhampton was slightly below it. In the Brisbane material young leaves gave consistently higher values than old growth taken at the same time and the same place.

(*c*) Feeding Tests.—No feeding tests with this grass have been reported from Australia. In India, feeding tests gave negative results and analysis showed the prussic acid level to be below the danger point.

TABLE 1.

PRUSSIC ACID CONTENT OF SPECIMENS OF AFRICAN STAR GRASS.

Date.	Moisture.	HCN (as received)	HCN (water-free material).	Locality.	Remarks.
	Per cent.	mgm. HCN per 100 gm. plant.			
3-3-41 ..	67·1	23·0	69·9	Blackall ..	A very hairy form
5-12-41 ..	76·6	12·6	53·8	Moggill ..	Sample of young leaf blades
5-12-41 ..	76·6	32·5	138·5	Moggill ..	Sample of young runner growth
20-5-42 ..	48·0	14·0	27·0	Moggill ..	Old growth. Partially dry
20-5-42 ..	67·0	18·6	56·4	Moggill ..	New growth. Very dark green
9-6-42 ..	66·0	16·2	47·6	Moggill ..	New growth. Very dark green
10-7-42 ..	60·0	5·9	14·8	Moggill ..	Old growth. Partially dry
10-7-42 ..	69·0	14·0	45·1	Moggill ..	New growth. Dark green
23-7-42 ..	58·0	21·3	50·7	Moggill ..	Old growth
23-7-42 ..	68·0	42·1	131·6	Moggill ..	New growth
5-8-42 ..	48·9	10·9	21·3	Moggill ..	Old. Partially dry
5-8-42 ..	58·7	22·4	54·2	Moggill ..	New. Mostly green
21-8-42 ..	61·9	18·0	46·2	Rockhampton	Old growth. In seed
23-9-42 ..	35·0	44·5	58·8	Moggill ..	Partly dead with some new green growth
23-9-42 ..	49·8	68·5	117·1	Moggill ..	New growth. Fairly green
20-10-42	29·4	3·6	5·9	Moggill ..	Old growth, mostly dry
20-10-42	56·5	10·1	23·4	Moggill ..	Mostly green
19-11-42	75·7	18·9	77·8	Moggill ..	New, mostly green
20-12-42	58·9	20·7	58·4	Moggill ..	Green, but somewhat wilted
21-1-43 ..	68·7	17·0	54·2	Moggill ..	New growth. Green but somewhat wilted

All analyses were made in the Chemical Laboratory of the Department of Agriculture and Stock, using the method described by H. Finnemore and C. H. Williams in Australasian Journal of Pharmacy, January 30, 1935. p. 41.

Symptoms.

Symptoms in animals poisoned by this grass have not been recorded. Other plants which produce prussic acid have been reported to cause accelerated breathing and pulse, laboured breathing and muscular twitching.

Post-mortem.

No post-mortem findings are on record for the grass. With other prussic acid yielding plants there are usually few lesions to be seen on post-mortem, except for reddening of the paunch and the development of a blue colour in the visible mucous membranes.

Prevention and Treatment.

Prussic acid formation occurs in a great many different plant species but in relatively few to the extent that poisoning becomes a danger. It may be seasonal or transitory and the amount present at different times is often subject to considerable fluctuation.

As a general rule, prussic acid formation in plants is greatest during a period of active growth following on a period during which the plant has had a set-back consequent upon drought, frost, grasshoppers or perhaps fire. It is in such circumstances that prussic acid containing plants are prone to be specially dangerous.

Plate 85.

African Star Grass.

On the other hand, plants which make smooth even though rapid growth from germination to maturity will usually fail to produce prussic acid in sufficient amount to be dangerous to stock. As plants mature the danger in general is considerably lessened, although it cannot always be entirely discounted.

As some doubt exists about the safety of African star grass when recovering quickly from a set-back, it is a wise plan under such conditions to test it first by allowing two or three animals access ahead of the herd or flock. In any event, hungry stock should never be placed on the grass.

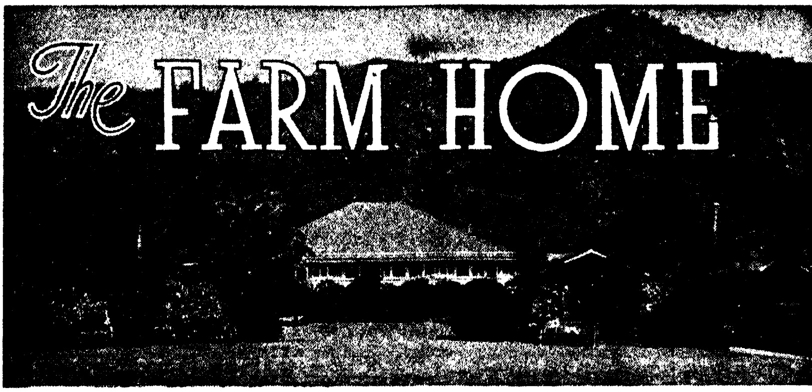
Care in the grazing practices used makes it unlikely that any trouble will be experienced. This grass has valuable properties as a fodder plant, and it is considered that these qualities more than outweigh the risk of poisoning.

Should cases of poisoning occur, antidotal treatment is usually very effective, always provided it is carried out with the utmost expedition after symptoms are first noticed. It consists of the administration, for cattle, of 2 oz. of sodium thiosulphate ("hypo") dissolved in about one pint of water followed by further doses of 1 oz. in water at intervals of 20 minutes until recovery occurs; for sheep, about one quarter of these doses will suffice.

It is essential that "hypo" be kept on hand ready for the emergency.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 13th JULY, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas.
Jersey	W. E. O. Meier, "Kingsford" Stud, Rosevale, via Rosewood.
A.I.S.	F. B. Sullivan, "Fermagh," Pittsworth.
Ayrshire ..	L. Holmes, "Benecculа," Yarranlea.
A.I.S.	D. Sullivan, Rossvale, via Pittsworth.
A.I.S.	W. Henschell, Yarranlea.
A.I.S.	Con O'Sullivan, "Navillus Stud," Greenmount.
Jersey	J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount.
Jersey	J. F. Lau, "Rosallen Jersey Stud," Goombungee.
A.I.S.	H. V. Littleton, "Wongalee" Stud, Hillview, Crow's Nest.
Jersey	G. Harley, Hopewell, Childers.
Jersey	Toowoomba Mental Hospital, Willowburn.
Jersey	Farm Home for Boys, Westbrook.
Jersey	F. J. Cox and Sons, Crawford, Kingaroy Line.
Friesian ..	C. H. Naumann, " Yarrabine " Stud, Yarraman.



Reasons Why You Should Breast Feed Your Baby.

HAVE you just been blessed with the most priceless possession it is possible to have—a young infant son or daughter? Or maybe it hasn't arrived yet but you are expecting one soon.

Whatever it may be, it is certain that you are determined that your infant is going to have the best start it can possibly have in life, and the greatest gift you can contribute towards this end is breast milk.

There is an old French proverb, which runs like this:

"The most loving act a mother can do is to nurse her baby.

Nothing can ever replace the milk and the heart of a mother."

This is as true to-day as it was hundreds of years ago. So as soon as you have a baby, make a resolution to nurse him at your breast for as long as possible up to 9 months of age. Let nothing deter your determination—neither old wives' tales, nor grand-parents, nor in-laws, nor stupid social conventions, nor convenience, nor even a previous failure with another infant.

After all, nature usua'ly knows best what is good for us and in breast milk she supplied the perfect food for all infants. Its constituent nutrients of protein, carbohydrate and fat, minerals, vitamins and water are all perfectly proportioned to suit the young infant's digestive powers, so if anyone suggests that your milk does not agree with your baby you can dismiss the suggestion with the contempt it deserves. Of course, some difficulties in feeding may arise, but these are nearly always related to one or more of three factors, namely:—

(*a*) The *quantity* of milk supplied by the mother;

(*b*) Faults relating to the mother herself or to her feeding technique;

(*c*) Faults relating to the baby.

These difficulties will be discussed at a later date, but in the meantime it is well to point out that a certain degree of anxiety is natural to nursing mothers until suckling is well under way and you have learned to enjoy the experience, as you undoubtedly will if you cultivate the right attitude of mind.

You should regard suckling as a natural, instinctive process, of great benefit to your baby and yourself, and your approach to it should be calm, placid and matter-of-fact. Your handling of the baby should be gentle, patient and loving. With this approach things should go smoothly and a perfect harmony develop between your infant and yourself.

It is all wrong to develop an intense emotional attitude towards breast feeding and to regard it as a formidable task which requires the assistance of professional experts to make it a success. It must be admitted that this attitude in nursing mothers, especially those nursing their first babies, has been fostered to some extent by doctors and nurses. Naturally enough, the clockwork regularity of the feeds and the frequent test weighings seem very impressive to young mothers who are keyed up at the thought of having a first child; if suckling is turned into a solemn rite, they are deeply interested in it, but half afraid to touch their babies in case of doing wrong!

So don't be too dependent on the advice and management of others. The doctors, nurses and clinics are there to help you and guide you, not to control and manage you. Use your own common sense and maternal instincts as much as you can.

Now to continue further with the advantages of breast feeding.

Breast milk not only contains the optimum proportion of nutrients for baby's digestion, growth and development, but it also contains certain antibodies, derived from the mother, which help to protect baby against the various infectious diseases of childhood, such as measles, whooping cough, and diphtheria, for varying periods averaging about 6 months after birth. This is an important factor, for these infections assume their most serious proportions during the first year or so of life.

What is more, the infective type of gastro-enteritis, which is a most serious disease in infancy, is very rarely found in breast-fed babies, for breast milk is sterile and the risk of contamination is small. All that is required is the normal cleanliness of breasts and hands—you do not have to worry about boiling your milk, scalding all your utensils and laboriously making up your mixtures. The incidence of infection and gastro-intestinal upsets is still significantly less in large groups of breast-fed infants as compared with those artificially fed, although the difference has become less marked with a higher standard of artificial feeding.

Successful breast feeding is also known to exert a favourable influence on the child's later emotional development. Infants in the first year of life are not dull of feeling or unconscious of their surroundings. On the contrary, they are sensitive to all kinds of impressions, and their habits of reacting to early experience of pleasure and distress are formed to last. The comfort enjoyed by the infant in contact with a soft breast instead of a hard bottle, and the confidence gained by the mother in supplying the infant's needs herself, are factors in the successful rearing of infants which may be assumed to have real importance.

Any further information on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's Terrace, Brisbane, or by addressing letters "Baby Clinic, Brisbane." These letters need not be stamped.

ASTRONOMICAL DATA FOR QUEENSLAND.

SEPTEMBER.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.03	5.33	Cairns	29	29	Longreach	35	35
6	5.58	5.36	Charleville ..	27	27	Quilpie	35	35
11	5.52	5.38	Cloncurry	50	50	Rockhampton ..	10	10
16	5.46	5.40	Cunnamulla ..	29	29	Roma	17	17
21	5.40	5.42	Dirranbandi ..	19	19	Townsville ..	25	25
26	5.35	5.45	Emerald	19	19	Winton	40	40
30	5.30	5.46	Hughenden ..	35	35	Warwick	4	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	9.48	8 21
2	10.44	8.53
3	11.40	9.27
4	..	10.06
	a.m.	
5	12.37	10.50
6	1.32	11.40
		p.m.
7	2.25	12.35
8	3·14	1.35
9	3.58	2.37
10	3.37	3.39
11	5.13	4 42
12	5.47	5.44
13	6.20	6.48
14	6.53	7.53
15	7.29	9.00
16	8.08	10.09
17	8.52	11.19
18	9.44	..
		a.m.
19	10.42	12.26
20	11.46	1.29
	p.m.	
21	12.52	2.24
22	1.56	3.10
23	2.58	3.50
24	3.58	4.25
25	4.54	4.56
26	5.50	5.25
27	6.44	5.53
28	7.39	6·22
29	8.34	6,52
30	9.30	7.25

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19; Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	13	24	29	40	3	15	32	46
6	8	31	24	46	0	22	25	54
11	14	23	29	39	4	14	33	45
16	26	12	43	26	18	1	50	29
21	30	9	45	24	20	0	53	26
26	19	19	34	34	10	10	39	41
30	11	27	26	43	0	18	29	51

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	15	40	40	58	25	43	14	34
3	6	49	35	63	20	49	6	41
5	3	56	34	67	18	53	4	46
7	2	56	33	67	17	53	3	46
9	8	49	36	63	21	49	8	41
11	17	38	41	57	26	42	15	33
13	28	26	50	47	34	33	24	22
15	41	13	57	39	42	24	34	13
17	52	4	66	33	50	19	43	5
19	57	2	69	32	53	17	47	3
21	54	3	67	32	51	18	44	4
23	43	11	60	38	45	23	36	11
25	33	23	52	45	37	30	27	20
27	22	33	45	54	30	38	19	29
29	12	43	38	59	23	45	11	36
30	8	48	36	62	21	48	8	40

Phases of the Moon.—Last Quarter, 4th September, 11.53 p.m.; New Moon, 12th September, 1.29 p.m.; First Quarter, 19th September, 6.54 a.m.; Full Moon, 26th September, 2.21 p.m.

On 24th September at 1 a.m. the Sun will cross the equator, and on this day seen from anywhere on earth it will rise and set at true east and true west respectively. On the 13th and 26th the Moon will rise and set at true east and true west respectively. On 12th September there will be a total eclipse of the Sun visible from Northern Asia and Alaska and the North Pacific Ocean; while on the 26th there will be a total eclipse of the Moon, which also will not be visible from Australia.

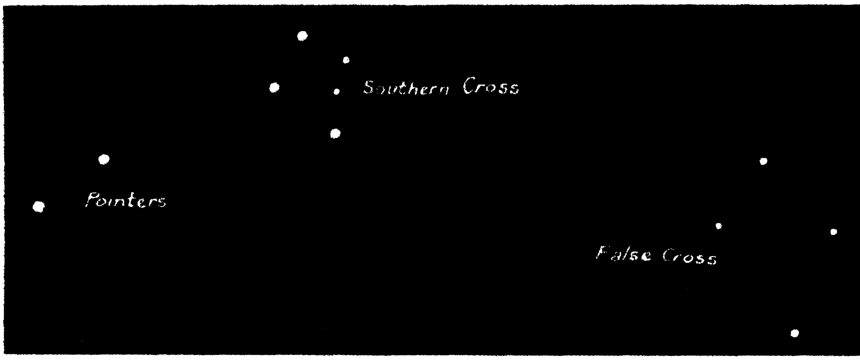
Mercury.—An evening object at the beginning of the month, when it will set over 1¾ hours after the Sun. By the 17th it will be in line with the Sun, after which it will pass into the eastern sky, and at the end of the month will rise ¾ hours before sunrise. On the 24th it will pass 2½ degrees to the south of Venus, after which it will be higher in the sky than Venus

Venus.—In the constellation of Leo; will rise less than 1 hour before the Sun at the beginning of the month; at the end of the month it is too close to the Sun for observation.

Mars.—In the constellation Virgo at the beginning of September, will set between 10.30 p.m. and 11.45 p.m., while at the end of the month it will set between 10.00 p.m. and 11.15 p.m.

Jupiter.—Will rise during the daylight hours and be well up in the eastern sky at nightfall. On the 1st it will set just before sunrise, but by the end of the month it will set between 3.45 a.m. and 5 p.m.

Saturn.—Too close to the Sun for observation, being in line with the Sun on the 16th.



THE CONSTELLATIONS.

CRUX.

The constellation to be discussed this month is Crux, or Southern Cross as it is commonly called. It is perhaps the most outstanding group of the southern sky and particularly for Australians, for it has been embodied in our flag. However, it is surprising how few Australians can point out this constellation in the sky, confusion often being caused with the false cross in the constellation of Argo not far distant. There is, however, a very simple way of locating the Cross by the two very bright stars in the constellation of Centaurus, which ''point'' to the Southern Cross and are always associated with it, being known as the ''pointers.'' In fact, to the ancients the Southern Cross formed part of the constellation of Centaurus, but became a separate constellation during the 15th century, though exactly when and by whom is not known. The relation of the ''pointers,'' Southern Cross and False Cross is shown in the diagram. The Southern Cross is visible as far as latitude 20° or 30° north, when it is seen rather low on the horizon at certain times of the year. Vasco da Gama mentions seeing it on his journey round the Cape of Good Hope in 1493, and Mollineaux showed it as a cross on his celestial globe in 1592. It is situated in one of the richest parts of the ''Milky Way'' and is a splendid conspicuous object at some time of the night for almost the whole year from anywhere in Queensland. It is seen in the early evening sky from January to September, being on the Meridian or North-South line about midnight on the 31st March. It will reach this position about 2 hours earlier each month, so that on January 31st it will reach the Meridian at 4 a.m. During that month it is seen on its side in the south-eastern sky during early evening, with the ''pointers'' below it and nearer the horizon. By the end of August the cross reaches the meridian at 2 p.m. (daylight) and is then seen at nightfall on its side in the south-western sky, with the ''pointers'' above it, the Cross then being nearer the horizon. From Queensland the Cross is below the horizon in the evening only from about the middle of October to the middle of December, thus tracing almost a complete circle in the sky, the centre of which is the South Celestial Pole, which is found by producing the long arm of the Cross about 4½ times its length.

There are a number of interesting objects in this region of the heavens, the brightest ''star'' of the cross being a triple, while the next brightest star is close to a cluster likened by Sir John Herschel to a collection of diamonds, rubies, sapphires and emeralds on a dark velvet interior of a jewel box. This ''Jewel Box,'' as it is known, is on the edge of the ''Coal Sack,'' the dark patch of apparently starless sky. The ''Coal Sack'' is really a mass of non-luminous obscuring matter called ''dark nebulae'' interposed between us and the starry background. Under high magnification, however, many stars are seen through this ''dark cloud.''

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5

Contents

Soil Conservation in Queensland.

J. E LADEWIG, Senior Soil Conservationist, and A. F. SKINNER, Soil Conservationist.

5. Contour Banks *(continued)*.

Building Contour Banks with Light Graders.

THE method of construction described and illustrated in the following pages is applicable to all types of blade graders when used for contour bank construction on slopes of less than 6 per cent., and where soil is moved from both upper and lower sides to form the bank.

The island is marked out as for the plough method and the same island width is allowed (Plate 86); where the soil is too hard for efficient earthmoving it is preferable also to carry out the first series of three rounds as described for the plough method.

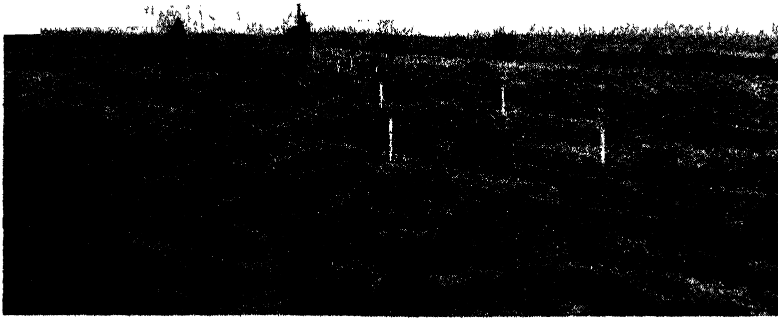


Plate 86.

The opening run of the grader is made so that the end of the blade follows the upper stake line and the soil is delivered on the upper edge of the island (Plate 87).

The return trip of this round is made with the grader centering on the lower stake line (Plate 88).

On the first run of the second round the grader is moved one foot upslope from the position for the opening run of the first round and is set so that it will cut the maximum depth; in this position the soil is delivered against the row from the first run (Plate 89).

The position of the grader for the return trip on the lower side of the bank is one foot downslope from the first round (Plate 90).

The third round is utilised to move the earth across the island; the grader is placed so that the leading point centres on the row of soil from rounds 1 and 2 on both upper and lower sides (Plates 91 and 92).

In the fourth round the grader is placed 12 inches further upslope than for the similar run in the third round, the cutting point being set as deeply as possible, and the soil spread evenly on the island (Plate 93).

In the return trip of this round the grader is placed 12 inches downslope from the position for the second round (Plate 94).

If the ground has not been ploughed prior to commencement of grading operations it is desirable to do so after the fourth round, particularly where light graders are being utilised.

Plate 95 illustrates the general method of ploughing in towards the island from upper and lower sides.

In the fifth round the position of the grader is similar to that of the third round on both upper and lower sides, the objective being to move the large volume of loose soil in to a centre position on the island (Plates 96 and 97).

In the sixth round the grader position is similar to that of the first round on both upper and lower sides, delivering soil on to the edge of the island on both sides (Plates 98 and 99). On the upper side the grader cutting point is set deep to provide a maximum depth in the water channel.

In the seventh round a further cut of a one foot upslope is taken on the outward run (Plates 100 and 101), and at the end of this run the blade is turned through 90 degrees so that the return run can be done on the upper side.

This run is used to commence the formation of the backslope into the channel, which should be a gradual slope; in this case the grader is set so that its cutting point is at ground level on the upper edge of the disturbed area, the heel of the grader being set to provide the desired slope (Plate 102).

The blade is again turned through 90 degrees at the end of the seventh round, and the first run of the eighth round used to move on to the bank the soil from the last run of round 8 (Plate 103).

The blade is again turned and the return run of the eighth round used to move the soil further up on to the bank (Plate 104).

Plate 87

Plate 88

Plate 89

Plate 90

Plate 91

Plate 92

Plate 93

Plate 94

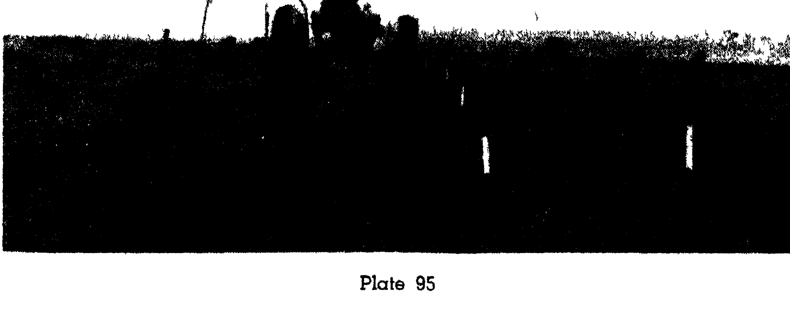


Plate 95

Plate 96

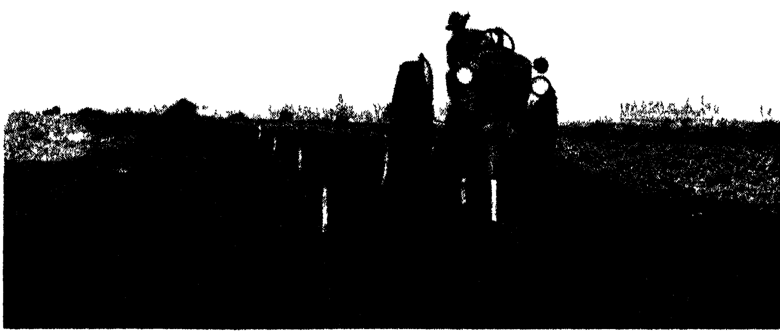


Plate 97

Plate 98

Plate 99

Plate 100

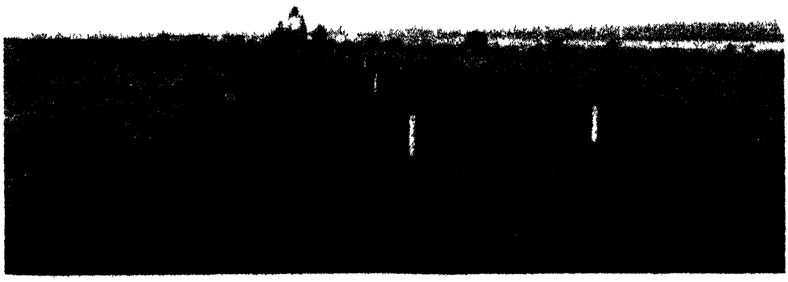


Plate 101

Plate 102

Plate 103.

Plate 104.

The opening run of the ninth round is carried out on the lower side of the bank to improve the general section and the return run of this round is used to form the backslope to the channel as in the return run of the seventh round (Plate 105).

The blade is turned for the opening run in the tenth round and this run is used to complete the formation of the backslope (Plate 106).

The return run of this round is used to move on to the bank the soil from the first run of this round (Plate 107).

The blade is again turned and the opening run of the eleventh round used to trim the upper section of the bank (Plate 108) and the return run to trim the lower section.

The completed bank section is illustrated in Plate 109, a typical broad base contour bank being constructed in eleven rounds with a seven-foot grader-ditcher drawn by a farm tractor.

Bank Construction with Large Graders.

Graders larger than those just described include the self-propelled motor graders and large drawn graders of a wide variety of types and sizes. Special terracing graders have also been developed for contour bank building work; the principal feature of these is their direct attachment to the tractor (absence of front wheels) to render them more suitable for this work.

Whilst procedure varies according to the design of the particular machine, the general principles of construction on moderate slopes are similar to those described for light graders.

Irrespective of the size of grader used for any of this work, the general efficiency of the work can be improved by repeatedly loosening soil ahead of the grader with either a strong plough or a ripper.

CONTOUR CULTIVATION.

These measures are often loosely described under the term "contouring," which refers to any tillage practice applied across the slope on the level—that is, on the contour. It will be obvious that a series of implement marks across the slope will serve as a series of miniature dams (Plate 110), whereas when applied up and down slope they serve as numerous drains expediting the flow of water from the land, lessening the opportunity for the soil to absorb the rain, and increasing the possibility of the removal of soil (Plate 111).

The pondage efficiency will depend on the type of implement used; the tyne marks of scarifiers on the contour will often pond the equivalent of 2 to 3 inches of rainfall, those of the harrows about half an inch.

Many of the erosive rains received in this State fall as high intensity storms of short duration; it is not uncommon to record storms in which one to two inches of rain fall in 20 minutes. The absorptive capacity of the soil varies according to soil cover, condition and type of soil, and its moisture content; in general it does not exceed half an inch in 20 minutes for many of the Queensland soils in midsummer, and consequently a high flash runoff on arable lands is associated with many of these high intensity storms of short duration. If contour cultivation

Plate 105

Plate 106

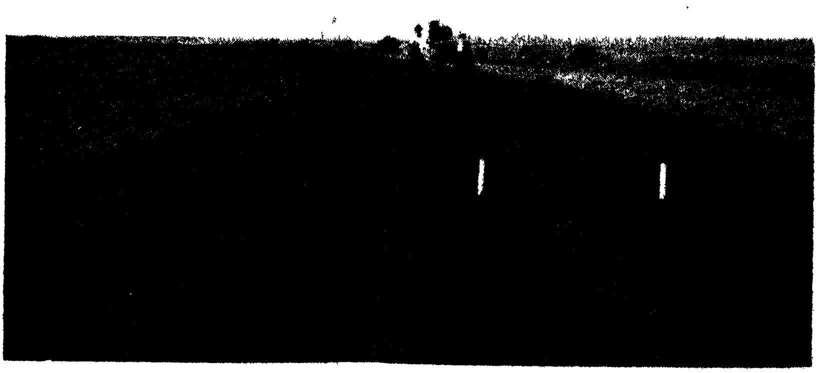


Plate 107.

Plate 108.

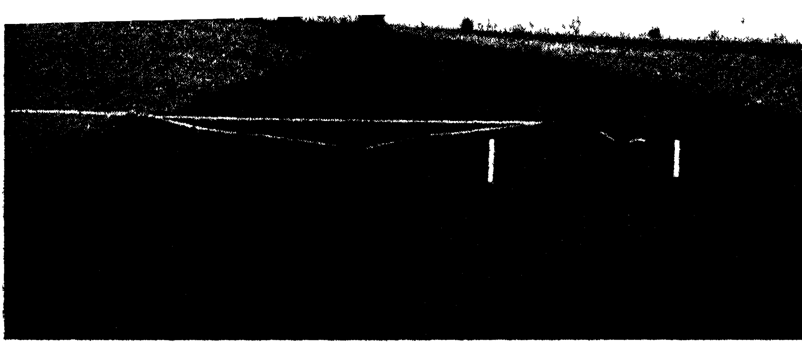


Plate 109.

is practised, even harrow tyne marks will pond an additional half-inch of rain which is absorbed by the soil *after* the storm has passed; consequently the erosion hazard is reduced and more rainfall is made available for crop growth.

These general principles apply to relatively gentle slopes, soils with a high absorptive capacity, and to any arable lands which are contour banked. When rain continues after the soil is saturated, runoff will commence despite contour cultivation methods, and unless provision is made to intercept this runoff with contour banks, serious erosion damage will occur. Rainfall exceeds the saturation capacity of the soils at least once annually in this State; therefore, in general, contour cultivation alone cannot be regarded as a complete protective measure for the arable lands unless the slopes are very gentle or the soil very absorptive. But where bank protection is provided, contour cultivation is very successful, particularly if surface puddling of the soils can be prevented by providing the maximum amount of soil cover in the form of growing crops or crop residues.

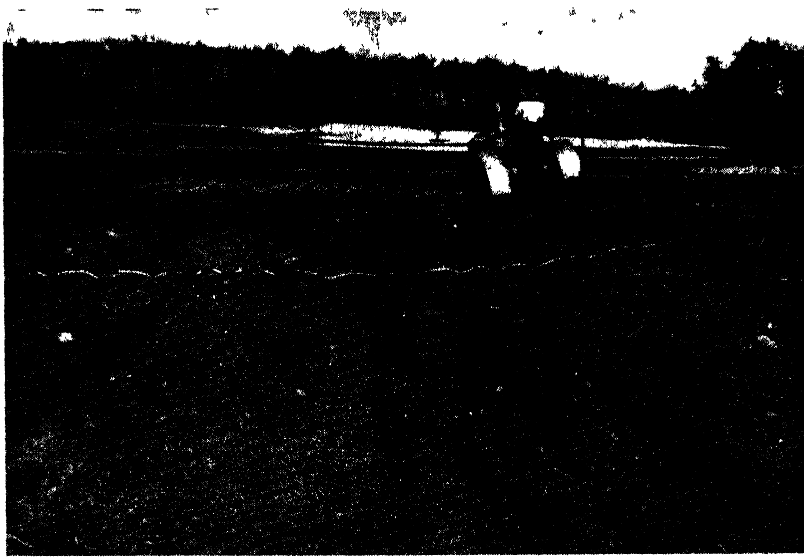


Plate 110

Cultivation on the Contour with a Scarifier. Each tyne mark serves as a miniature dam.

Plate 111.

Severe Rilling along Wheat Rows where Round-the-Paddock Planting has been Practised

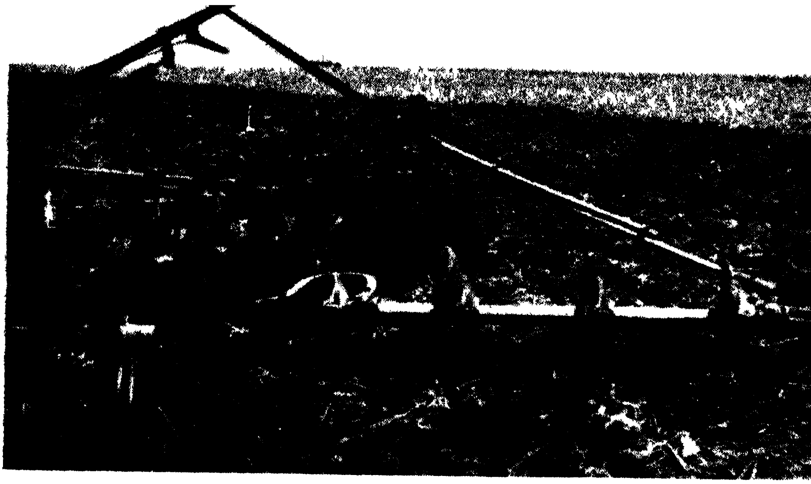


Plate 112.
The Muirhead Stormtrap Attachment Fitted to a 14-Disc Sundercut.

Plate 113
Water Held in Basins Formed by the Stormtrap Attachment The photograph was taken after a two-inch storm. Each basin has ponded the equivalent of one inch of rain which would otherwise have been lost as runoff

The operation of implements on the contour presents obvious advantages, chiefly uniformity in operating speeds and usually a reduction in fuel costs. Finish-out furrows are on the level and consequently do not present the erosion hazard so prevalent where corner finish-out furrows are associated with "round-the-paddock" cultivation methods.

Basin Listing.

Special pondage procedures are often associated with contour cultivation methods with the object of ponding additional rainfall. In the United States of America basin listing on the contour is extensively practised. This involves the construction, with special machinery, of a series of deep parallel furrows on the contour; they are check banked at intervals along their length and present the appearance of numerous basins. This type of basin listing has not been utilised in Queensland, although a modified system has been developed on the Darling Downs, using an implement attached to a cultivating plough or sundercut (Plate 112); when ploughing operations are complete the field has the appearance of a series of small basins. The initial pondage capacity of these basins is approximately two inches of rain. This attachment, though not fully tested to date, offers considerable promise for the temporary pondage of rainfall (Plate 113), particularly during those periods when sundercuts are utilised for land cultivation.

Contour Ripping.

Where sub-surface plough-pans exist and hinder the free passage of moisture through to the subsoil, contour ripping or subsoiling procedures are proving very effective in reducing runoff. The effectiveness of this work is dependent on conditions of soil type and soil moisture; since the treatment cost is high and the benefits only semi-permanent, the general adoption of this practice will be determined by economic considerations.

APPLICATION OF CONTOUR CULTIVATION METHODS.

Where there is a variation in the width of the land between two contour banks the application of contour cultivation may present problems, particularly in relation to the planting of row crops. Standard practical procedures have been developed, and though a little more difficult than orthodox practice do not present any insuperable difficulties in their general application.

Contour Ploughing.

Apart from the advantages of contour cultivation, the success of any system of contour banking depends primarily on maintenance and management of the banks. The most important operation in bank maintenance is correct ploughing. All ploughing should be parallel to the bank, and it is preferable that a finish-out or dead furrow be located in the channel and a crown or backfurrow on the crest of the bank; in this way the cross-section of a well-built contour bank can be maintained and smaller ones can be improved.

The method of ploughing usually adopted in conjunction with contour banks is illustrated in Plate 114; this method is defective in many respects but is adopted generally because it involves the least change from orthodox agricultural practice and is suited to the large plant units used in the wheat growing areas.

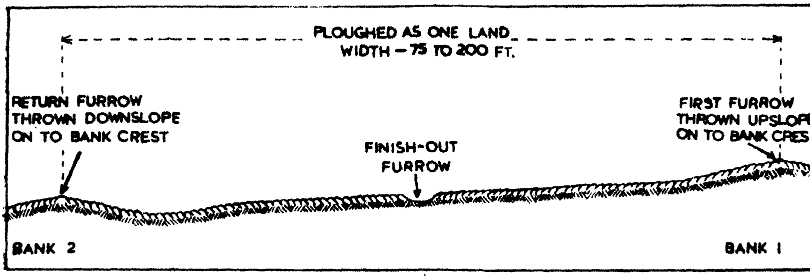


Plate 114.

The Standard Method of Contour Ploughing Usually Adopted in Queensland.

It is obvious that in areas where ploughs or sundercuts are used extensively the continuous practice of this system will result in the development of a basin at the site of the finish-out furrow and there will be a progressive movement of the soil towards each bank. The use of tyne implements where possible will assist in surmounting this problem, but where ploughs or sundercuts must be used it is desirable to vary the ploughing method each year. Alternative methods are illustrated in Plates 115 and 116; these are most suited where small manœuvrable ploughs are used, but even with larger equipment modifications of these methods may be utilised.

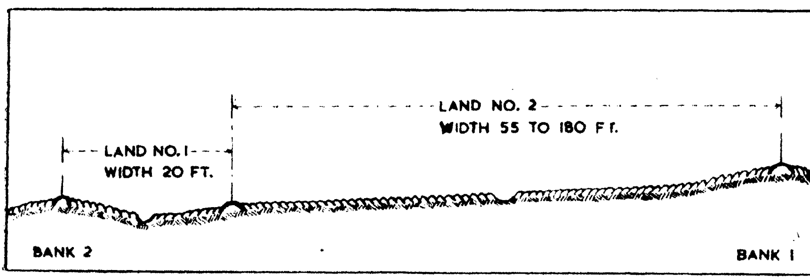


Plate 115.

A Method of Contour Ploughing Which Ensures Maintenance of Bank and Channel Dimensions. The finish-out furrow is in a different position from that shown in Plate 114.

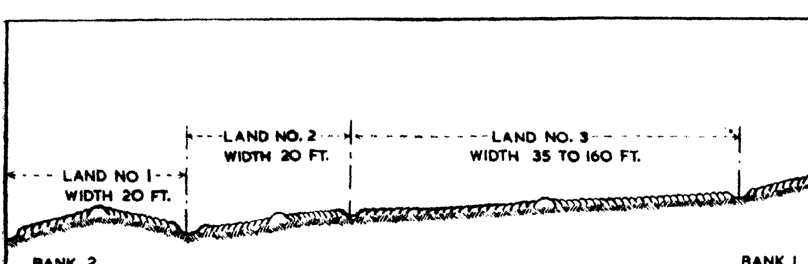


Plate 116.

A More Difficult Method of Contour Ploughing. Since it reverses the movement of soil it can be alternated with other methods.

Contour Planting.

The cultivation operations affected most adversely by a variation in width between banks are those of planting and, in the case of row crops, their subsequent cultivation. Three planting procedures may be followed; each will be described for general guidance.

1. Commence planting operations along the contour bank and extend the sowing out an equal distance on each side of the bank until the rows adjoin those of the next bank at the narrowest point. A uniform planting area is thus assured without the cultivation and harvesting difficulties associated with short rows or triangular areas. The odd sections of land are then utilised for pasture or a permanent hay crop such as lucerne. This method is illustrated in Plate 117.

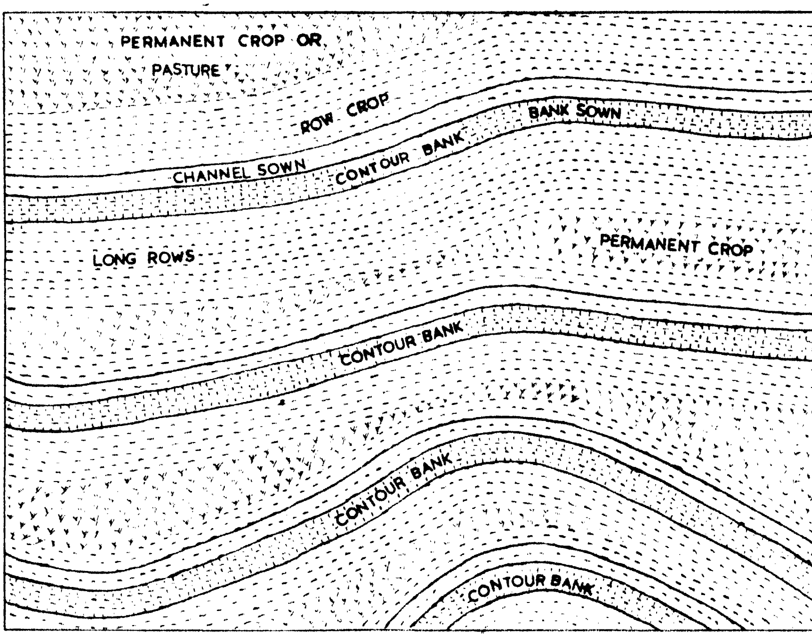


Plate 117.

This Method of Planting is the Simplest and Obviates the Difficulties Associated With Short Rows and Irregular Areas.

2. Commence planting along the lower side of one bank and along the upper side of the bank next below and continue operations in towards the centre of the interbank space until the two areas meet at the narrowest point. The remaining irregular-shaped areas are sown as short rows. The advantage of this system is that no productive land is lost to the crop, although some difficulty is experienced when cultivating the short rows. This system is not entirely satisfactory with row crops which are hilled, because of the possibility of excess runoff accumulating in the short furrows and being discharged at the centre of the interbank space; this water discharge overloads the hills of the lower rows and erosion may occur at that point. This method is illustrated in Plate 118.

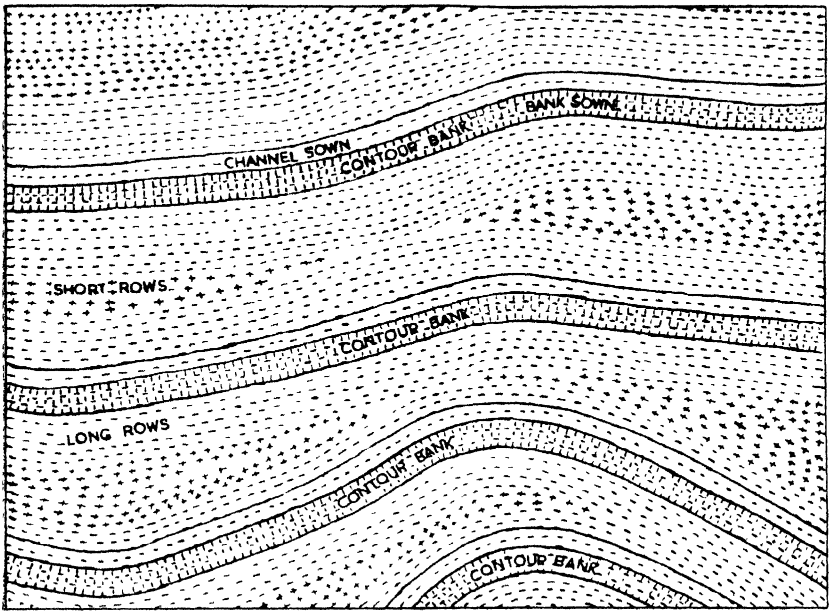


Plate 118.

More Land is Available for the Cash Crop When This Method is Used, but the Cultivation of Short Rows Presents Difficulties.

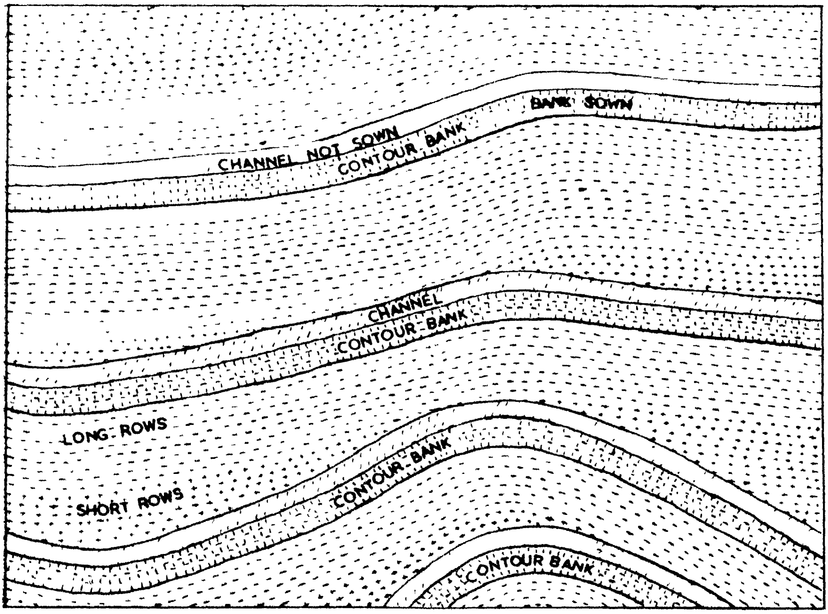


Plate 119.

In This Method the Channel is Used as a Headland to Turn Implements When Cultivating the Short Rows.

3. Commence planting along the lower side of a bank and extend the planting parallel to and below this line until the short rows end in the channel of the bank next below. The channel is left unplanted and is used as a turning point for implements used in cultivation operations. This method is the one most used in the field, and though it is not as satisfactory as the first method described, no land is lost to the particular crop being sown. This method is illustrated in Plate 119.

The application of contour cultivation procedures using existent machinery requires some minor adjustment to current agricultural methods; the saving of soil and water and the resultant maintenance or improvement in crop yields more than justify the effort.

The development of power lift implements and implements directly attached to tractors, and the increasing use of hydraulic equipment, tend to simplify the application of contour cultivation methods. As these improvements are incorporated and there is developed a wider appreciation of the value of soil conservation, contour cultivation will become as widespread and as simple to apply as the present round-the-paddock systems.

THE LATE CYRIL WHITE.

The death occurred on August 16 of Mr. C. T. White, who had been Government Botanist, attached to the Department of Agriculture and Stock, since 1917.

Mr. White was known personally to thousands of Queenslanders. His journeyings throughout the State in the interests of economic botany brought him into contact with country people in the most remote areas, and each year hundreds visited him in Brisbane to obtain his advice on native and introduced plants. Numerous articles on pasture plants, weeds and trees were written by him for this journal and other farmers' publications.

In the field of plant identification and classification, Mr. White had a world-wide reputation, and scientific organisations in many countries entrusted plant collections to him for naming. He spent a period at the Royal Botanic Gardens at Kew, in England, working on Australian collections there on behalf of the Commonwealth and State Governments.

The University of Queensland conferred a Master of Science degree on Mr. White in recognition of his services to botany, and he was for many years a fellow of the Linnean Society of London.

His wide knowledge of botany and his eagerness to assist people to know the plants of the countryside better will be sadly missed.

The Commercial Production of Green Manure Seed in the Cairns Hinterland.

E. W. BAIRD, Adviser in Agriculture.

THE practice of including a leguminous green manure crop in the cane rotation is extensively followed in the sugar-cane growing areas of coastal Queensland, and to supply the demand for seed in northern areas a considerable quantity of seed is required.

Commercial seed production of green manure legumes in the wet coastal areas is not practicable, but the soils and the drier climate of the Cairns hinterland, particularly Mareeba and the lower rainfall areas of the Atherton Tableland, are well suited to the purpose. Moreover, the fact that these districts are within easy distance of the large cane-growing areas north of Townsville is an advantage. Seed production of green manure legumes is now a useful source of income to many farmers in the Mareeba and nearby districts, and with an assured demand, which is likely to increase, there is every reason to expect that the acreage devoted to this form of cropping will expand.

Cultivation of the various legumes follows the same general pattern. As a rule the seed is sown in late December or January and the crop develops through the wet season, being harvested in the autumn and early winter months when drier conditions are normally encountered. Legume seed crops are useful in maintaining soil fertility in a crop rotation and fit in very well with the cropping programme where maize and peanuts are also grown, as is the case for example in the Carbeen district.

The main legume seeds produced are those of four varieties of cowpea—giant cowpea, Groit cowpea, Cristaudo pea and Reeves Selection. Seed of the most common green manure legume, Poona pea, which is also a variety of cowpea, is not produced. There is little demand for this legume in the far northern canefields because of its susceptibility to wilt when growing in soils which become waterlogged during the summer wet season.

Seeds of velvet beans and Gambia pea are also produced in some quantity.

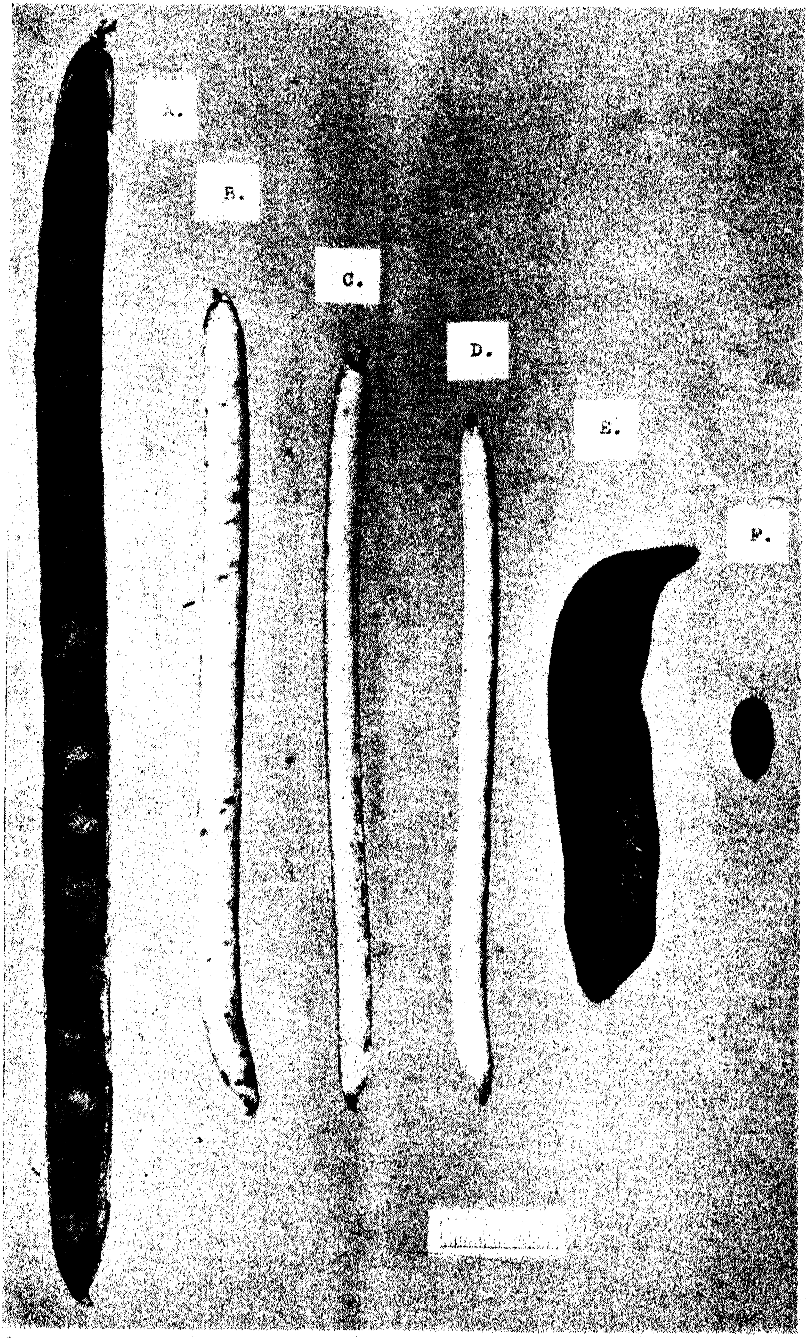


Plate 120.

Pods of Green Manures.—A., Giant cowpea; B., Cristaudo pea; C., Groit cowpea; D., Reeves Selection; E., Jubilack velvet bean; F., Gambia pea.

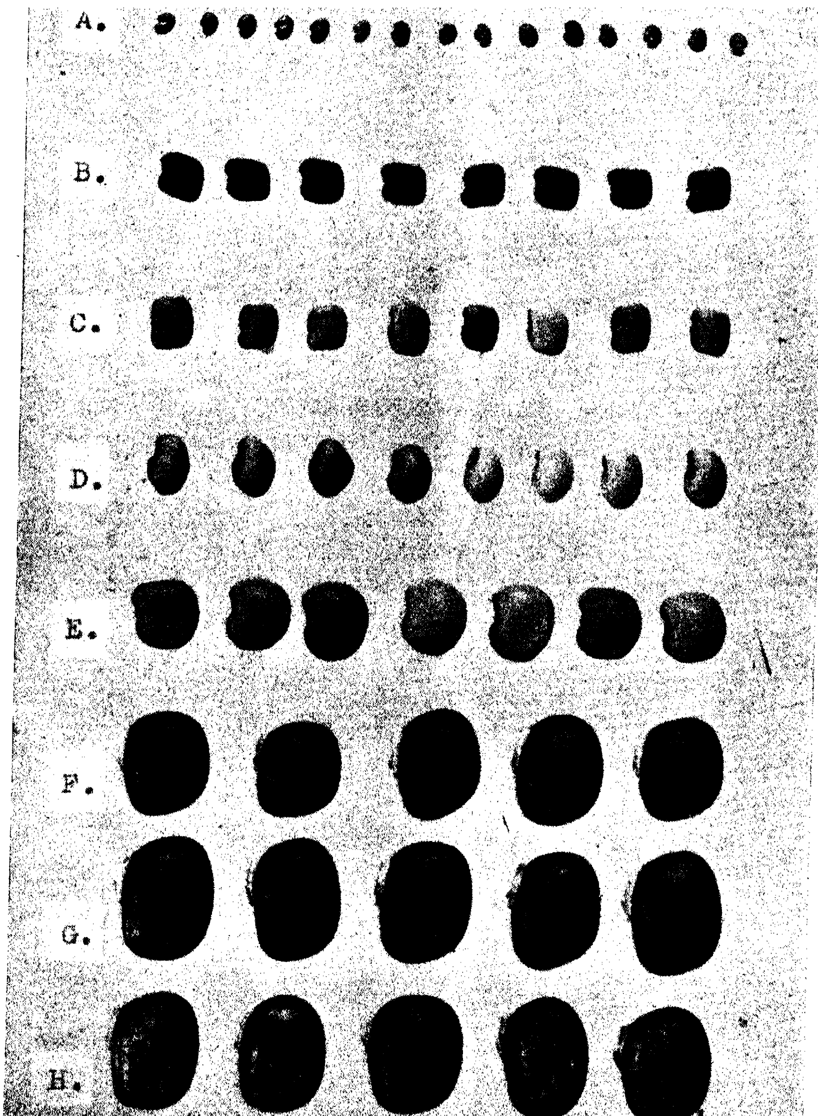


Plate 121.

Seeds of Green Manures.—A., Gambia pea; B., Groit cowpea; C., Reeves Selection; D., Cristaudo pea; E., Giant cowpea; F., Black Mauritius bean; G., Jubilack velvet bean; H., Somerset velvet bean.

COWPEAS.

Giant Cowpea.

This variety is grown for seed mainly in the Mareeba district, where the soil types and dry climate (35 inch average annual rainfall) seem very well suited to its growth. It appears to be satisfactory on a wide variety of soils, including red-brown loams of basaltic origin and brown and grey sandy loams of granitic origin. Poorly drained soils, however, are unsuitable, and because of the susceptibility of the variety to nematodes, two or more successive crops should not be grown on the same land.

Beneficial results have been obtained by rotating giant cowpea crops with maize, peanuts or grass fallow. In some districts a practice is developing of growing the legume with the main maize crop, but this is not recommended in areas of high rainfall because of harvesting difficulties.

The crop thrives best on land which has been thoroughly prepared to eliminate weed growth and conserve subsoil moisture. The most suitable time for planting is in January. On slopes where soil erosion may occur, giant cowpea, in common with similar cowpea seed crops, is planted on hills which have been formed previously; otherwise no hills are used and seeding is carried out "on the flat."

Row spacing varies according to preference of the individual grower, but usually rows 4 ft. apart are used with one or two seeds sown every 3 ft. along the row, to give an approximate seeding rate of 5 lb. per acre. This spacing permits cultivation, which is carried on as long as the incidence of the wet season and the inter-row growth of the plants permit.

Plate 122

Early Growth of a Giant Cowpea Seed Crop.

Plate 123.

Harvesting Giant Cowpea Seed. Note the bags of pods in the background.

With a January planting the crop makes its growth through the very wet months, and the main harvesting is carried out in May and June, when drier conditions prevail Dry harvesting conditions are essential, otherwise seed and pods may be discoloured by rain and the pods may become very brittle. In earlier planted crops, harvesting of pods may commence in late March if the weather is dry enough.

Hand harvesting of the pods is usual, the pods being stacked under cover and threshed later. They must be quite dry for threshing, which is usually most efficient when carried out during the afternoon. The pods do not split lengthwise readily and must be crushed, hence the necessity for dryness. Threshing is carried out by the usual corn or peanut thresher.

Harvesting may be spread over a considerable period, depending on the labour available. However, undue exposure of ripe seed in the field is inadvisable because of the risk of bean bruchid attack.

Because of the fleshy nature of the stalk, the prolific vine growth, and irregular ripening of the pods, giant cowpea does not lend itself readily to mechanical harvesting. There are machines which could handle the crop, but the cost is far beyond the capacity of the individual grower. This problem could best be met by the group purchase and operation of a suitable machine on a co-operative basis.

An average yield in the areas under consideration is 10 to 15 bushels per acre. The total annual production is about 6,000 bushels of seed. To produce seed of high standard, adequate seed cleaning facilities should be available on the farm. In many samples which are marketed, the trash content lowers the standard, and there is scope in this direction for considerable improvement.

Groit Cowpea.

As a green manure, Groit cowpea has been popular in the coastal cane areas for many years. The seed crop is grown almost exclusively in the Tolga-Kairi section of the Atherton Tableland, where about 2,000 bushels are produced annually.

The crop is sown at the rate of 4 to 6 lb. per acre in drills 3 ft. to 3 ft. 6 in. apart.

This fine-stemmed variety lends itself to machine harvesting. The method adopted is to cut the plants at ground level with a sharp hoe or cane knife when approximately three-quarters of the seed pods are mature and commencing to dry. The severed plants are allowed to cure in the field for several weeks, depending on weather conditions. They are then cocked, stacked, and later threshed. The whole of the vine passes through the thresher, which is adjusted suitably to take the large volume of plant material. As well as recovering a good seed sample, a good quality chaff for stock food is obtained. Sometimes it is necessary to pass the seed once more through the machine for extra seed cleaning purposes. Yields of 10 to 15 bushels of seed are commonly obtained.

Reeves Selection.

This variety has been developed as a result of selection work in Queensland and has gained popularity in coastal districts because under waterlogged soil conditions it is more resistant to wilt than Poona pea.

In growth, Reeves Selection is more inclined to a bush habit than giant cowpea and for this reason it is grown in rows which are only 3 ft. apart; seed is spaced 6 to 12 inches apart along the row, giving an approximate planting rate of about 4 lb. per acre.

Plate 124.

Early Growth of a Reeves Selection Cowpea Seed Crop.

The seed can be mechanically harvested similarly to Groit cowpea. Under average conditions, 15 to 25 bushels of seed per acre can be produced. In 1948-49, about 500 bushels of seed were produced in the Mareeba area, and production seems certain to expand.

Cristaudo Pea.

It is believed that this legume, sometimes known as Ingham pea, originated from a selection from Clay cowpea made by a farmer at Ingham. Coastal cane farmers have created a demand for seed of this variety, which is credited with pest and disease resistance of a much higher order than Poona pea.

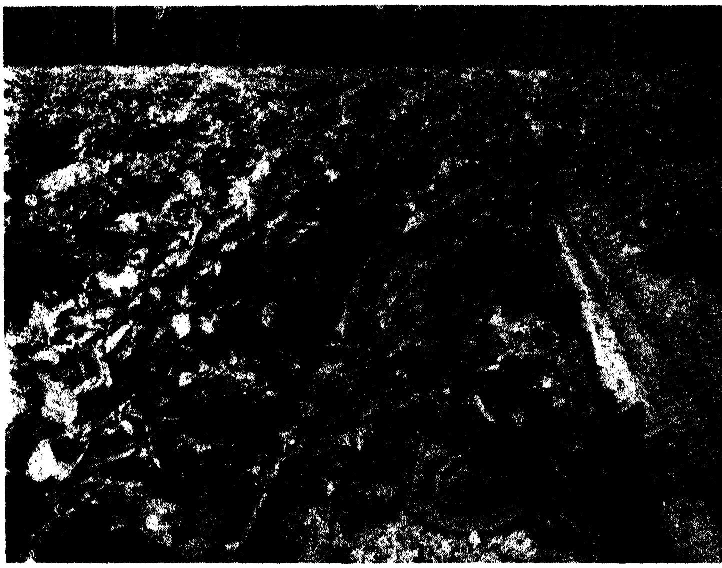


Plate 125.

A Young Crop of Cristaudo Pea Being Grown for Seed.

Cristaudo pea thrives in the Mareeba area and it is expected that seed production will increase. It is grown in rows 3 ft. 6 in. to 4 ft. apart, with 6 inches between plants in the row, giving a seeding rate of approximately 4 lb. per acre.

Like Groit and Reeves Selection, it can be efficiently harvested by machine. Yields of up to 35 bushels per acre have been obtained, but 20 bushels per acre is a satisfactory average.

VELVET BEANS.

Velvet beans will thrive on a wide variety of soil types and the plants show drought resistance of a high order. Uneven germination is a feature of this legume, but excellent strikes are obtained in the Carbeen area (average annual rainfall 40 inches), where rainfall and soil appear to suit seed production very well. Good seed yields have also been obtained from Paddy's Green in the Mareeba district.

Best results have been obtained where the velvet beans are grown in association with maize as a supporting crop to make collection of the pods easy. Care must be taken to ensure that the vigorously

Plate 126.

Black Mauritius Velvet Bean Grown for Seed on a Supporting Crop of Maize.

Plate 127.

Velvet Bean Grown on Maize for Seed. At the left, the maize is turned down below the cob to facilitate harvesting of the bean pods.

growing prolific vines are not planted so thickly as to weigh down and break the maize stalks. For this reason it is usual to plant the seed in every second row of maize, which has an inter-row space of 4 feet. One or two seeds are dropped along alternate rows 6 ft. apart, giving a planting rate of 4 lb. per acre.

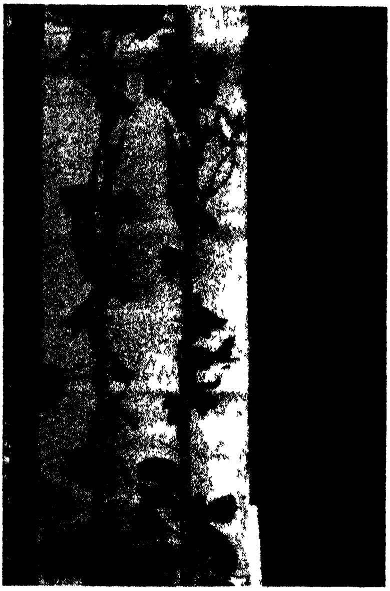


Plate 128.
Velvet Bean Supported on Maize for Seed Purposes.

Planting of the velvet bean seed is carried out after the maize has germinated and the rows can be seen clearly. It is not advisable to allow the maize seedlings to be more than 6 inches high before planting the legume, as shading seems to stunt growth.

The practice of growing velvet beans for seed in association with maize appears to be a sound one where machine harvesting of maize is not adopted. It permits of two cash crops being produced on the same land at the same time without detriment to either.

The varieties recommended for seed production are Somerset, Jubilack and Black Mauritius. In a trial at Mapee, near Tolga, in the season 1948-49, these three varieties yielded 1,257 lb., 1,192 lb. and 786 lb. of seed per acre, respectively.

Somerset is a large vine which is relatively easy to harvest. The seed is large and may not be popular with cane farmers. Jubilack produces a large vine which is also easy to harvest. Its general characteristics suggest that it would be a very useful variety for seed production purposes. Black Mauritius, although not such a heavy yielder as the two varieties already mentioned, is very easy to harvest, as the pods are borne in large clusters. All three varieties grow good green manure crops. Rate of maturity of each is about the same as that for maize.

Hand harvesting is followed, the pods being pulled from the vine, stacked, and allowed to dry thoroughly before threshing with a corn or peanut sheller. In order to facilitate hand harvesting, a practice adopted by some growers is to bend over the maize stalks just below the maturing cob. Not only does this make harvesting of the velvet beans easier, but in the event of wet weather the bent maize cobs shed water more readily and the maize appears to suffer less from cob rots.

Separation of seed from the pods is not easy, especially if the pods are not thoroughly dry, but the corn sheller does a reasonably satisfactory job. Sometimes the pods are spread on galvanised iron sheets in the sun to make the pods burst, and horses or a tractor are driven across them to complete the bursting process. This method is not recommended, as it damages the seed too much.

More than 1,500 bushels are produced annually in the Tolga-Carbeen-Mareeba area, and with increasing demand and good prices production can be expected to expand.

GAMBIA PEA.

Seed of this legume has been produced to a limited extent in rotation with the tobacco crop. Owing to the difficulties encountered in establishing it on prepared ground, it has lost favour with seed producers. However, it regenerates reasonably well on hard ground and volunteer crops are used as sources of seed supply in various areas

Plate 129.

Gambia Pea in Flower and Forming Pods.

Harvesting by hand is tedious because the pods and the seed are small, and this is also an unattractive feature to the seed grower. Pods must be picked at maturity. They are easily threshed, and in fact if harvesting is not carried out promptly the pods show a marked tendency to shatter and shed seed.

A trial in which a reaper and binder was used for harvesting Gambia pea seed was carried out recently in the Mareeba area. The sheaves were threshed as soon as possible to avoid loss of seed due to shedding. The seed was recovered by hitting the sheaves against the inside of a small tank, as in the old method of threshing peanuts by hand. The seed obtained was later winnowed to remove trash.

PESTS AND DISEASES.

The various cowpea varieties grown for seed in the Cairns hinterland are susceptible to bean fly injury, but under good growing conditions seed crops are rarely troubled by this pest. Reeves Selection is said to be more resistant than Poona pea. Velvet beans and Gambia pea are not worried by bean fly. Should severe bean fly infestation of any of the seed crops threaten, DDT sprays should be applied.

Pod borers affect all the seed crops, but appear to be less troublesome in velvet beans than in cowpeas. DDT preparations should be used to combat these pests.

The cowpeas are susceptible to nematode infestation, but it is rare in the Mareeba area to have a seed crop seriously affected. However, the fact that cowpeas do harbour nematodes means that they should never be rotated with nematode-susceptible crops such as tobacco. Velvet beans and Gambia pea appear to be highly resistant to nematodes and so appear to be safe to rotate with tobacco and other nematode-susceptible crops.

All the cowpea varieties described have a degree of resistance to wilt, and Giant, Reeves Selection and Cristaudo pea at least are much more resistant than Poona pea.

Harvested seed is very susceptible to attack by bean bruchids and mites, but it can be stored safely in bags or tanks after thorough treatment with 2 per cent. DDT dust used at the rate of 5-6 oz. per cornsack (150 lb. cowpea seed).

FREE EXAMINATION OF SEEDS.

Samples of seed purchased by farmers for their own sowing are examined free at the Department of Agriculture and Stock, Brisbane.

Samples should be marked to show the kind of seed, number of bags from which sample was drawn, quantity purchased, name and address of seller, and name and address of sender.

Samples should be of the following size:—

	oz.
Cereals, beans and peas	8
Lucerne, millets, Sudan	4
Grasses	2
Vegetable seeds	$\frac{1}{2}$

Harvesting and Packing Tropical Fruits and Strawberries.

GENERAL HARVESTING CONDITIONS.

AS in the case of other fruits, care is essential for the successful handling of tropical fruit. Climate and temperature when harvesting is in progress are big factors in the successful carriage of tropical fruits to local and distant markets. These fruits are of such a delicate nature that every care must be taken to avoid carelessness and rough handling. Care should be taken by growers to see that fruit after harvesting is allowed to cool before being packed. Close attention to this point is necessary if fruit is to be carried over long distances and is expected to be in a satisfactory condition when it arrives on the market. Fruit packed while in a heated condition holds the heat for a long period during transit, thus causing premature ripening or sweating, with the certainty of the consignment opening up in an over-ripe or wet and musty state, which is just the condition suitable for the development of moulds and transit rots. Fruit in this plight has only a short commercial life, and has to be sacrificed by the agent to distributing retailers for rapid disposal, usually necessitating a substantial reduction in price to ensure a quick sale. Such sales often have a detrimental effect on the price or the demand for sound consignments. By taking advantage of the time of the day, and picking the fruit while its condition is unheated, pre-cooling is made considerably easier. If necessary, after picking, spread the fruit out in a cool place to reduce its temperature before packing.

PACKING THE PRODUCT.

Care in Making Cases.

Growers, after taking every care in handling their fruit while harvesting and packing, often, through carelessness in making and nailing down cases, offset an advantage already gained by careful handling. Careless nail-driving, causing nails to protrude inside the box from the timber of the case, often results in damaged fruit with consequent waste. Nail-marked fruit decays, breaks down, and affects adversely the sound fruit in the box. Nails protruding through the outside of a case are a danger to all handling it in transit, often causing bad cuts or loss of temper, and rough handling in consequence. Extra care in such matters is well worth while, and saves trouble.

The " Get Up " of the Package.

Attractiveness is the main feature to be studied, anything added or done to make the product worth more to the buyer being a big factor in quick sales and higher prices. The following points are well worthy of consideration :—

Use only clean, well-made cases. Second-hand cases should be thoroughly cleansed before using again.

Plain white or coloured paper is much more attractive and cleaner than newsprint, while the extra cost is only a fraction of a penny.

Where it is necessary to use padding, clean woodwool is preferable to most types of other material.

Fancy labels are an improvement, but if using stencils or rubber-stamps, care should be taken to apply them neatly and so avoid smudging and spoiling the appearance of the finished package. The packer's full name and address, with variety and contents of the case, as required by the Fruit and Vegetables Act, should be embodied in labels or stencils.

Wiring the case is an improvement. Often the wiring together of two small cases to make one package is an economy and an insurance against the rough handling of smaller packages. Wiring is also an attraction to the buyer who desires to despatch fruit to distant places.

CUSTARD APPLES.

Harvesting.

Picking custard apples at the right time is essential in keeping buyers and consumers satisfied, besides helping in keeping up the demand. Custard apples picked too soon inevitably go black and become unsaleable and unattractive. The fruit should be picked when it is in a firm mature condition to ensure good carrying and ripening qualities. A good indication of the correct time to harvest custard apples is when the interstices between the corrugations of the fruit have turned to a rich creamy colour. Fruit picked at this stage, if firm, will carry well and ripen excellently. Packing will present no difficulties if the operations of sizing and packing are carried out separately.

Sizing.

To obtain the best results when marketing custard apples, care should be taken to pack the fruit in the best possible manner for marketing. Clean cases, nicely stencilled with the packer's name and address and the number of fruit in the case, add to the market value of the product. Most custard apple growers consider it unnecessary to size and pack their fruit. Like all other fruits, when this is done the value is considerably raised, from both seller's and buyer's points of view. Buyers do not like to purchase fruit of mixed sizes, as they have no means of arriving at what a case containing varying sizes is going to realise when sold at so much per individual fruit at prices varying according to the size. When a case is sized this return can easily be calculated, and a price paid accordingly. When a buyer cannot calculate the actual return he is likely to receive for a case of fruit, it is only to be expected that he will be careful to safeguard himself and pay a lower price than the fruit is actually worth.

Sizing is an operation that should be carried out in the shed before packing. An excellent sizing table is one with a flat top, covered with clean sacks, with a 3-inch high beading around the edge to stop the fruit from rolling off. For best results the operator should size by hand into at least four different heaps of fruit of approximately even dimensions. It is also advisable to clean the fruit by carefully brushing if its appearance is affected by mealy bug or other pests.

Packing.

By packing two different counts from each heap, packers will size the fruit automatically into six or seven sizes. The best container is the dump half-bushel case, 18 inches by 7⅛ inches by 8⅝ inches internal measurements. For the larger sized fruit, with the counts, 8, 10, 12, and 14, the case is best made up in the narrow way—viz., 18 inches long by 7⅛ inches wide by 8⅝ inches deep (see Plate 130); but for the smaller sized fruit, with the counts 15, 18, and 21, the wide way, 18 inches long by 8⅝ inches wide by 7⅛ inches deep, will be found most satisfactory (see Plate 131).

Following are the packs and counts:—

NARROW CASE PACKS.

18 inches long by 7⅛ inches wide by 8⅝ inches deep.

Pack.	No. in First Layer.	No. of Layers.	Total.
1 x 1	4	2	8
1 x 1	5	2	10
1 x 1	6	2	12
1 x 1	7	2	14

WIDE CASE PACKS.

18 inches long by 8⅝ inches wide by 7⅛ inches deep.

Pack.	No. in First Layer.	No. of Layers.	Total.
2 x 1	8	2	15
2 x 1	9	2	18
2 x 1	11	2	21

These packs and counts should pack any average sized line of custards, but growers with only a small quantity would possibly not need to do all of these counts.

With very large fruit it is better to adopt a single layer tray of a suitable depth. For distant markets the single layer tray is the best container. Owing to the irregular shape of the fruit, commonsense has to be used in getting the fruit to fit in snugly, careful selection of irregular-shaped fruit to match each other being a great help in obtaining a good pack. Force should not be used under any circumstances. A bigger latitude in sizing is necessary in handling custard apples than in handling fruit such as citrus or tomatoes. Only a quarter of an inch variation is allowed in citrus and kindred fruits, but the variation in the sizes of custard apples will greatly exceed this according to the shape of the fruit. One of the main objects of packing is the protection that it gives the fruit, and growers when packing want to keep this object in view. As custard apples soften first at the point,

First Layer 1 x 1 Custard Apple Packs.

Count—1st Layer.

10 Count—1st Layer.

12 Count—1st Layer.

Note the protection given to the soft points of the fruit.

Finished Cases.

Count—Finished Case.

10 Count—Finished Case.

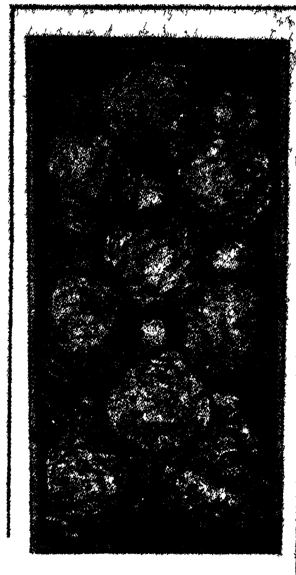
12 Count—Finished Case.

Plate 130.

ustard Apple Packing for the Local Market.—Large sizes. Australian Half Dump Case. Case made on narrow system 18″ long x 7½″ wide x 8⅝″ deep.

2 x 1 Custard Apple Packs

18 Count—1st Layer



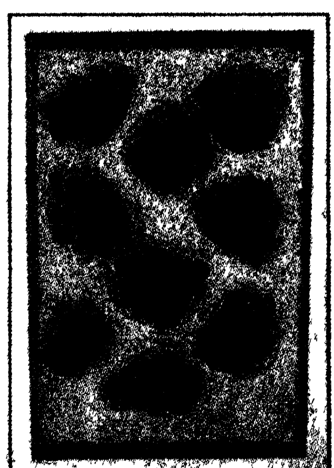
18 Count—Finished Case

Note the protection given to the soft points of the fruit

Plate 131

Custard Apple Packing for the Local Market—Small sized fruit Case made on the wide system 18" long x $8\frac{1}{3}$" wide x $7\frac{1}{8}$" deep

Case prepared with woodwool for placing the Custard Apples on



Finished case with the top layer of woodwool removed Note the padding between each fruit

Plate 132

Custard Apple Packing for Export.

or opposite end to the stalk, the packer wants to keep foremost in his mind the placing of fruit to the best advantage to protect the parts which might soften first while in transit. By keeping the point of the fruit turned inwards from the wood of the box the maximum amount of protection is obtained from bumps and vibration during handling and in transit. A study of the illustrations will help to explain this.

If a packer happens to use other counts and packs than those given here, close attention to the protection of the fruit will be of assistance in good transit and satisfactory condition on arrival at the markets. Cases should be packed high enough above the top of the box to allow a slight pressure to be placed upon the fruit by the lid when nailed down. Care should be taken that there is no loose fruit in the case, as the constant rattling and vibration in transit will soon render the fruit unfit for sale. It is well to remember that one broken custard apple will often make a mess of the whole consignment.

Packing for Export.

For long distance transport the best container in the single layer—half-bushel standard, 18 inches long by 11½ inches wide by 5¼ inches deep—tray with the fruit nested or padded in woodwool (see Plate 132). The tray is first prepared by placing a layer of woodwool on the bottom and around the ends and sides. The fruit is then placed in position in a single layer with a small space between each fruit. It is advisable not to wrap custards when sending long distances, as it hastens the process of ripening. Woodwool is then placed in the spaces between the fruit to form a small pad for each fruit, and a layer is spread on the top of the pack and the case nailed down. The whole case should be packed so that it will not rattle when shaken gently. Fruit packed in this manner carried to Tasmania for show purposes, and although soft on arrival was exhibited for three days, and was then in still good eating condition. Fruit packed without woodwool in the same type of container was unfit for consumption on arrival at the show. Care should be taken that no fruit projects above the top of the tray before nailing down. Two trays wired together make a handy package for transport over long distances. No difficulties in marketing should be experienced by growers if judgment and commonsense are used in handling these fruits.

PAPAW PACKING FOR DISTANT MARKETS.

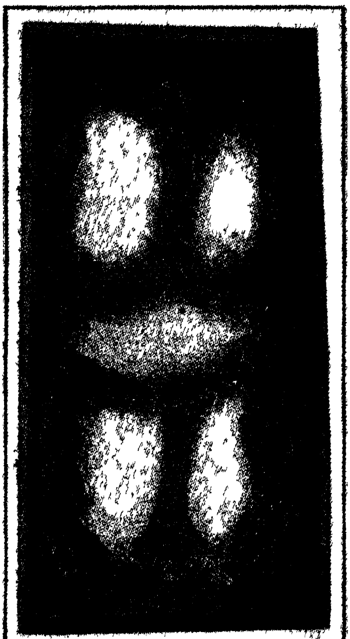
Sizing.

In packing papaws the foremost idea in the mind should be the best method of giving the maximum protection to the fruit in transit, and the packing of the fruit so that it will display to the best advantage when exposed for sale. Before being packed the fruit should be cooled and sized. To assist in making the operation of packing easier, it is a great help to endeavour to match the various-shaped papaws whilst sizing them into heaps. Four sizes should be sufficient to cover the packing of papaws for export. Sizing is easily done on a flat-topped table covered with soft bags or other suitable material. Many growers do not think it necessary to go to this trouble, failing to appreciate that the skin of the papaw is exceptionally tender, and that the slightest scratch will cause the fruit to bleed, thus damaging the appearance of the fruit.

Packing.

The best container for long-distance carriage of papaws is the tropical fruit case, 24¾ inches long by 12 inches wide by 12 inches deep, internal measurements (see Plate 133). Woodwool is the most satisfactory padding material. The box is prepared by placing a layer of

woodwool on the bottom of the case and around the ends and the sides. Each papaw is then wrapped in soft paper and placed in a single layer in the prepared box, using small pads of woodwool to make individual fruit firm and snug. A thin layer of woodwool is then placed over the top of the fruit, and the process is repeated until the case is full, finishing off with a layer of woodwool padding on the top. It is unwise to have the fruit projecting too far above the top of the box, but the lid of the case should press just firmly enough to keep the fruit snug and firm. Packers should avoid placing too much padding in the case. Care in matching the various-shaped fruit will greatly assist in this. By using a coloured wrapper in conjunction with the woodwool a very attractive package can be placed on the market. Care in eliminating all green, over-ripe, or diseased fruit when packing is absolutely necessary to ensure safe transit and satisfaction to buyers.



Packed in Tropical Fruit Case 24¾" x 12" x 12". Fruit wrapped in soft paper and nested in wood wool.

Plate 133

Papaws Packed for Export.

Packed in the Dump Case used as a tray by removing the side, 18" long x 14¼" wide x 8¾" deep. Note the wood wool padding between the fruit

Plate 134.

Papaws Packed for Local Market.

Packing for Local Markets.

Growers who are near enough to their markets to be able to use motor transport have a decided advantage over those who have to send over long distances. The fruit can be left on the tree to become almost fully ripe before sending to market, and it is not necessary to pack in the same manner as when sending farther afield. Close attention should be paid to the elimination of all disease-infected or marked fruit, and sizing should also be rigidly adhered to. The Australian dump case, made in the form of a tray 18 inches long by 14¼ inches wide by 8¾ inches deep, internal measurements, is a good container for the local market (Plate 134). The fruit is packed on end in a single layer resting

on a layer of woodwool or similar packing. As a protection against rubbing the bottom end of each fruit, it should be wrapped for about two-thirds of the way up in clean white or coloured paper, while each fruit is made snug and tight by pushing pads of woodwool in between the fruit. Papaws packed in this way have a very attractive display value, and sell much more readily than those carelessly placed in cases without padding material, the buyer being able to appreciate the quantity and quality at a glance.

MONSTERA DELICIOSA.

Packing for Distant Markets.

This is a fruit that is not well known outside Queensland. Many people tasting the monstera for the first time are favourably impressed, and are keen to know where supplies can be secured. Many specimens of this fruit bought by people, however, do not come up to expectations because growers are afraid to allow the fruit to stay long enough on the plant on account of its tendency to fall to pieces when ripening. This tendency can be overcome by winding a strip of paper around the fruit when packing, to prevent the outside shell from falling as the fruit ripens. Fruit packed like this will ripen over its entire length, and still retain its full flavour when consumed three weeks after being harvested. The standard half-bushel case, 18 inches long by 11½ inches wide by 5¼ inches deep, internal measurements, is an ideal case for the monstera. The fruit is packed in layers and made snug by placing a thin layer of woodwool on the top and bottom and between the layers. Lining the case with clean white or coloured paper is an added improvement to the appearance of the case.

PACKING STRAWBERRIES.

Containers.

Many containers are used for marketing strawberries. In some of the southern States a punnet is in general use, but as this container has the disadvantage of containing more than one layer of berries with each layer resting upon the other, it is not as good a container as the single layer packed boxes in general use in Queensland. There are two types of boxes in use—one which measures 8 inches long by 4 inches wide by 1¼ inch deep, and the other 24 inches long by 8 inches wide by 1½ inch deep. (Both are internal measurements and the latter box is measured clear of a central partition which it has). The smaller of the two containers is preferable, because it gives less latitude for mistakes and spoiling the appearance and alignment of the fruit when packing. Being smaller, it will not give the fruit as much play to become loose in the box through careless handling, so causing damage through rubbing and otherwise. It is also a better container for retailing, the larger box or tray, which contains the equivalent of six smaller boxes, holding too much fruit for the average buyer, necessitating repacking into smaller boxes. As the strawberry is such a soft fruit, it is necessary to handle it as little as possible. The smaller container also has the advantage of allowing better sizing and packing when the supply of fruit on the farm is short for marketing. Twenty of the boxes 8 inches by 4 inches by 1¼ inch will just fit comfortably into a half-dump case.

Handling.

Unlike other fruits, the strawberry does not necessitate a large, complicated, costly equipment in the packing-house to size and grade. This is done by hand, and much labour can be saved by grading while picking. Sizing is best done in the packing-house.

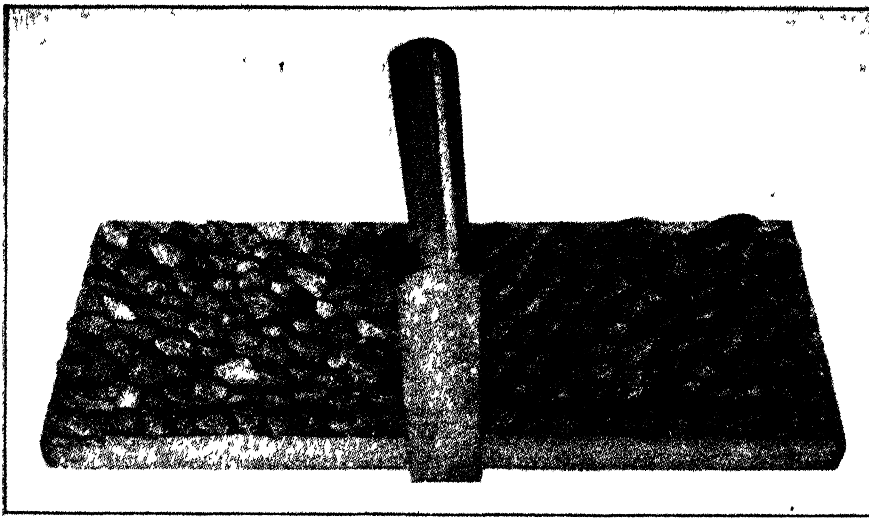


Plate 135.

Picking Tray Filled with Fruit.—Note the different grades and colour of fruit that are placed at either end of the tray when picking

A good picking container is a tray with a handle (see Plate 135) When picking, the first-class berries fit for marketing can be placed at one end of the tray, and second-class or factory berries placed at the other. By doing this the berries are automatically graded. Berries are packed for market in three sizes—threes, fours, and fives. Sizing is done while packing, the packer having a box for each size. Women and girls usually make the best berry packers, having as a general rule a lightness of touch which is often lacking in the case of men operatives. Berries with grains of earth adhering to them, as is often the case after rain, should be gently brushed. This can be done by placing a soft lacquer brush as a fixture, standing upright in the bench, and by taking the berry by the stalk and gently running it through the bristles of the brush.

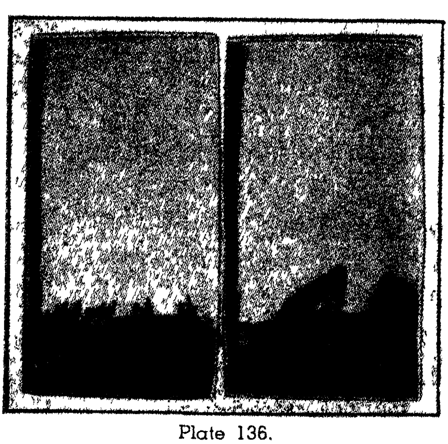


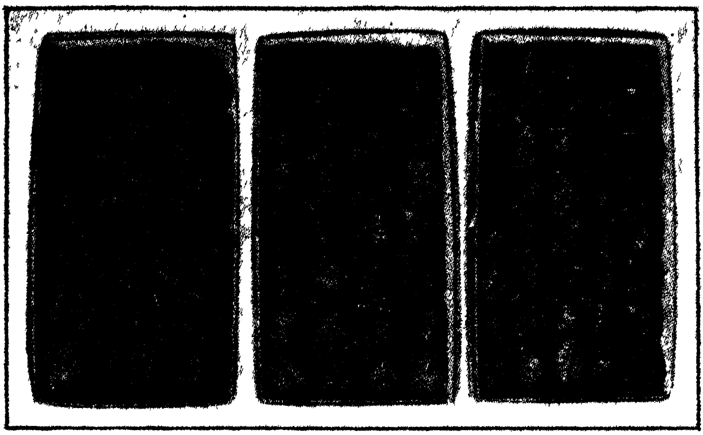
Plate 136.

Method of Starting to Pack.—Note the placing of the leaves to separate the fruit.

Packing.

The method of packing is simple enough. The box is first prepared by placing a prepared leaf across the end of the box —passion fruit leaves are very suitable, while fern leaves are sometimes used where passion fruit leaves are not available—with the leaf projecting high enough to reach to the top of the box, and at the same time being bent enough to place thereon the first line of berries—threes, fours, or fives, according to size. The berries should be placed on their stalk ends with the points up, allowing the point of the

fruit to reach to the level of the top of the box (see Plate 136). Another prepared leaf is then placed in the box, bent so as to rest on the bottom of the box to have the next line of berries placed thereon, while the remainder of the leaf rests against the first line of berries and acts as a separator of the lines of fruit. This process is repeated until the box is filled (see Plate 137). For travelling, a layer of leaves placed on top of the finished pack is an assistance.



Threes. Fours. Fives.

Plate 137.

Finished Boxes.—Note the alignment of the fruit in each box, also the placing of the leaves between each row of fruit.

Points to be watched are—

See that the fruit is placed so that it will come as near as possible to the top of the box, and it will then keep snug when the lid is placed in position.

Avoid packing too high.

Keep the alignment of the fruit straight both across the box and from one end to the other (see illustrations of packed boxes).

Avoid placing too large pieces of packing leaves between the berries.

See that the berries do not rattle in the box after the lid is placed in position.

Keep all badly-coloured berries out of the box, as they spoil the commercial appearance of the package when displayed for sale.

On no account pack damaged berries, no matter how slight the damage—they spoil the keeping qualities of the box. One bad berry soon makes a whole boxful practically unsaleable.

It is recommended that growers should stamp the pack of the fruit on the lid of each box, so that when being sold the seller can see at a glance whether they are threes, fours, or fives without having to remove the lids. This would be in addition to the name and address of packer required by law in letters $\frac{3}{16}$ inch at least in height to be stamped on the top of the lid and the end of the box. Use rubber stamps, as they are quick in application and make a finished job. When sending away packed in cases, see that stencilling is done neatly and free from edge of the stencil plate smudges.

Wool and World Trade.

G. R. MOULE, Director of Sheep Husbandry.

World Wool Production.

WOOL is produced in nearly every country in the world, and it may be classified broadly into two types:—(1) Clothing wools, which are used for the manufacture of wearing apparel; and (2) Carpet wools, which are made into carpets and floor coverings.

England, Spain and Germany held pride of place as the world's main wool producers until the second half of the 19th century. With the development of the sheep industry in countries of the southern hemisphere, the combined sheep population of Britain, France, Germany and Spain fell from 90 millions to 72 millions in the 70 years 1840-1910 At the same time the sheep population of Australia, South Africa, New Zealand, Argentine and Uruguay rose from 5 millions to 240 millions. In Australia the increase in numbers was accompanied by an increase in cut per head from an average of 4.9 lb (greasy) in the 5-year period 1876-81 to an average of 8.18 lb (greasy) in the 5-year period 1935-39. Further expansion in sheep numbers during the interwar period brought the Australian clip in 1940 to 1,077 million lb (greasy); South Africa produced 333 million lb (greasy), and New Zealand 260 million lb. (greasy) in the same year. Of the world total of 4,000 million lb. of wool, over half was produced by the five southern hemisphere countries—the three British Dominions, Argentine and Uruguay. Australia contributed a quarter of this amount, and is the greatest single producer of apparel wool

The United States of America, Canada, the United Kingdom, Germany and France occupy the 6th to 10th places amongst producer countries and they are also the first five deficit countries. Of the five, the United States has the largest domestic production, though this has decreased appreciably in the last decade. However, even when America's annual clip was 450 million lb. it was insufficient for her domestic requirements; the present precarious state of her wool industry may have an important influence on the future of world wool

The annual averages for the 5-year periods 1909-13 and 1939-43 show that there was an increase in world production of apparel wool from 1,685 million lb. to 2,182 million lb. over the 30 years. During this

period cotton production increased from 10,000 million lb. to 13,000 million lb., and rayon and staple fibres, which had just entered the field prior to the first world war, rose to 2,589 million lb. per annum by 1939. Substitute fibres now provide 14 per cent. of the world's apparel fibre, and wool, despite the increase in world wool production, supplies only 12 per cent.

Year-to-year changes in the amount of wool produced in the world have been relatively small. In only two years out of 34 has it varied by as much as 10 per cent. and these fluctuations have been mainly in Merino wool. They have been caused by factors largely beyond the control of the grower, such as droughts, parasites and diseases. Deliberate changes in production have occurred, such as in Australia, where there was a swing to crossbred sheep during the war years in response to a call for coarser wool and more mutton. However, because of a lack of alternative uses to which the land can be put, and the rigidity of fixed production costs, the grower often has little opportunity to vary the type of wool produced.

This means that world wool production has expanded in response to a steady demand for wool. Future production seems assured, although increases like those witnessed over the last 50 years are unlikely to be repeated, as most of the sheep pastoral areas in the world are developed. There may be increases in the cuts per head and decreases in preventable economic loss as pests are controlled and the effects of drought are ameliorated. The future of wool production will be controlled, however, by the continuance of economic production.

World Wool Consumption.

With the exception of the two post-war periods, the annual world carry-over of wool has been small. The combined total stocks of the three British Dominions and Argentine have been below 7 per cent. in 11 of 14 consecutive years. They did not exceed 10 per cent. in any year, the highest being 9.7 per cent. at the end of 1931-2. The two principal Merino countries, Australia and South Africa, have had the lowest carry-over, which has usually been less than 3 per cent.

However, the composition and intensity of world demand has been subject to strong fluctuations, which have been reflected in price changes rather than in volume of trade.

Up to 1938, the United Kingdom and European countries (mainly France, Belgium and Germany) dominated the market, purchasing between them up to 80 per cent. of the surplus apparel wool exported from the five main producer countries. Japan entered the market after the first world war and increased her annual purchases of Australian wool from 2 per cent. of the clip in the 5-year period 1909-13 to 18 per cent. in the 5-year period 1929-33.

Importations of Australian wool by the United States of America have always been erratic. In 1935 they were 95 million lb. (greasy); in 1936, 32 million lb.; in 1937, 69 million lb.; and in 1938, 6.5 million lb. These variations have been closely connected with changes in American home production, which averaged in the vicinity of 450 million lb. per annum. The 1934-38 per capita consumption of wool in America was in the vicinity of 2.5 lb. (clean) per annum, which compares unfavourably with that of European countries which have a high standard of living. The per capita consumption of the United Kingdom, for instance, during

the same 5-year period was 5.27 lb. (clean). Australia's average for the period was 4.63 lb. (clean), while that of Japan was 1.26 lb. (clean), of Poland .99 lb. (clean) and of the Soviet Union .87 lb. (clean). The low rate of wool consumption in America is due to differences in living conditions, as well as to the tariff barrier which gives other fibres a favourable price differential. Since 1939 there has been a decrease in the number of sheep in the United States. However, high ruling rates in the world's wool markets, coupled with high labour costs in America's manufacturing industries, have restricted American importations during more recent years.

Despite the fact that the Soviet Union, India, Pakistan, and China contain three-quarters of the world's population, they absorb only 2-4 per cent. of the world's wool.

The average wool consumption per head, as well as an income basis. is shown in Table 1.

Wool consumption has fallen from 14 per cent. of the world's apparel fibre in 1909-13 to 12 per cent. in 1939-43, when it supplied 2,540 million lb. (clean). At the same time, world consumption of staple fibres has increased. In the 5-year period 1909-13 they provided 2 per cent. of the apparel fibres, and in 1939-43, when total production was 2,851 million lb., they provided 14 per cent.

While there is competition on a fibre basis, there is also rivalry on a fabric basis; for example, a brief visit to any surfing beach in Queensland will reveal the trend towards non-woollen swimming costumes. Finally, there is competition on a price basis. Synthetic "tops" were quoted at 22½ pence per lb. when woollen "tops" varied from 28½ to 48¾ pence per lb. at a time when greasy wool was 15 pence per lb.

Wool Prices.

It is well known that wool prices have always been subject to violent fluctuations, but it should be remembered that, in the inter-war period, they were about as great as those of other commodities. The fluctuations were more marked in crossbred than in Merino wools, but the crossbred industry had the stabilising effect of mutton and lamb sales.

As wool is sold by open auction, supply and demand have an important bearing on price. These relationships might be summarised as being:—

The Influence of Supply on Price.—Large variations in individual clips are usually small when compared with the variation of the world's wool; the maximum variation in world supply is about 5 per cent. (except during unusual times such as war, when large stock piles may accumulate).

The Influence of Price on Supply.—Short-term variations in price are unlikely to influence supply because of high capital charges and the time factor in production. However, long-term depression in prices can be important, and may lead to variations in the type of husbandry practised.

The Influence of Demand on Price.—The cost of the raw wool in a manufactured article is low and accordingly changes in price have little effect on the price of the end product. On the other hand, the variation in the income which can be spent on clothes is great and thus

demand fluctuates. During depressed periods, the adverse effect of falling incomes on the level of wool consumption is likely to be much greater than the counteracting effect of lower raw wool prices.

To sum up, then, it is safe to say that the influence of variations in wool price on demand for wool is much less than the influence of changes in demand on wool price.

The Influence of the War.

During the recent war, the main wool producing countries were comparatively unaffected except for shortages of labour and materials, while the principal manufacturing countries were disorganised.

Marketing would have been interrupted except that the Governments of the allied countries bought up the world's surplus wool. Over 10 million bales produced in three Dominions went into store, besides the large stocks which were built up in America under the control of the Commodity Credits Corporation.

The "shoddy" trade, which re-uses wool from discarded garments, lapsed. The woollen manufacturing industries in Australia, Canada, South Africa, the United States, and presumably Russia, expanded, and the majority of the new mills were equipped with new machinery.

At the end of the war most wardrobes were worn out and there was a tremendous demand for wool. During the first year of auctions the United States bought 300 million lb. of Australian wool, while the Continental mills were going through a period of readjustment. During the next year (1947) Continental competition became more intense and prices rose. In 1948 the United Kingdom and Europe dominated the market, with Australian mills in full support. The Soviet Union pushed prices still higher, although its purchases were restricted in quantity. Finally, in 1949 Japan entered the market.

In the meantime, American buyers concentrated on the Argentine clip, which sold at lower prices, as wool was not included in Marshall Aid. The proportion of Merino wool purchased in Australia decreased, and the proportion of coarser crossbred wool used in the United States increased.

Queensland's Position and the Future.

Queensland's sheep population has not increased appreciably since 1890, when the State carried practically 20 million sheep. The present population is about 16 millions, although it was 24 millions in 1942. However, the cut per head has increased and the total wool production has also improved.

The value of the State's overseas exports rose from £151 million for the 10-year period 1911-1922 to £278 million for the 10-year period 1934-1945. Of these totals, wool provided £74 million and £111 million respectively. The value of Queensland wool for the last 4 years has totalled over £100 million.

The present decline in Queensland's sheep numbers is consistent with world trends. The number of apparel wool producing sheep in the world has decreased to 318 millions, against an average of 341 millions and a 1942 peak of 357 millions. Apparel wool production has decreased to below the 1934-1938 level and Merino wool production is lower than in any year since 1920. Seven-eighths of Joint Organisation stocks have been disposed of and consumption of wool is 20 per cent.

above the pre-war average. While a decline in consumption may be expected in the United States, this may be offset somewhat as far as Australia is concerned by the devaluation of sterling. An increase in consumption may be expected in Europe and Japan, but competition from other fibres will have to be met on a price and quality basis.

TABLE 1.

Country.	Average Wool Consumption, per Head, 1934–8. Lb. Clean.	Wool Consumption, per Head.	Income, per Head.
		Order of Magnitude.	
United Kingdom	5·27	1	3
New Zealand	4·65	2	2
Australia	4·63	3	6
Belgium	4·55	4	10
Sweden	3·55	5	8
France	3·52	6	7
Switzerland	3·32	7	4
Argentine	3·00	8	5
Germany	2·87	9	9
U.S.A.	2·66	10	1

In preparing the series of articles on wool which have appeared in this journal during recent months, information published by the following workers has been drawn upon freely:—Prof. A. F. BARKER (University of Leeds), Mr. H. B. CARTER (C.S.I.R.O.), Mr. W. R. LANG (Gordon Institute of Technology, Victoria), Mr. P. R. MCMAHON (Sydney Technical College), and Mr. E. H. MERCER (C.S.I.R.O.).

Publications of the Australian Wool Board and the International Wool Secretariat have also been used.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 18th AUGUST, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas
A.I.S.	F. B. Sullivan, "Fermagh," Pittsworth D. Sullivan, Rossvale, *via* Pittsworth W. Henschell, Yarranlea Con. O'Sullivan, "Navillus Stud," Greenmount H. V. Littleton, "Wongalee Stud," Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Kingaroy
Ayrshire	L. Holmes, "Benecoula," Yarranlea
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman J. F. Dudley, Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, *via* Rosewood J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount J. F. Lau, "Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Childers Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, Crawford, Kingaroy Line

A Survey of Data on Group Herd Recording, 1948-49.

S. E. PEGG, Senior Adviser (Herd Recording).

THE original object of a herd production recording scheme was to obtain reliable information on the productive capacity of each cow in the herds of farmers joining the scheme which could be used as a basis for improving individual herds. Herd recording is still practised basically for this purpose, but in recent years it has been found that the mass of information accumulated in connection with herd recording may yield on thorough analysis valuable information on many factors of great importance to dairy farming economy generally.

Preliminary investigations of herd recording data have been commenced in Queensland. This article deals with surveys made of information derived from the first year's operations of group herd recording. The group system, commenced in January, 1948, replaced the "farmer's own sample" scheme which had operated since 1920. As the group scheme is only in its infancy in Queensland, it must be recognised that the information contained in this survey is only a guide; moreover, due to the vagaries of the seasons in this State, the real effect of many factors on various aspects of dairying can only be determined reliably in the light of a survey covering a number of years. In view of the different pastures, fodder crops and other environmental conditions in the various dairying districts, it may also well be that surveys of some aspects of herd recording data must be conducted on a district basis.

So far as the present survey is concerned, the results will also be affected to a minor extent by the fact that production records included for cows which calved between February and June will be only those of animals with very short lactations.

Length of Lactation.

The average length of lactation of cows which completed lactation periods was 220 days.

The average length of lactation for the various districts was:—

District.	Days.
Darling Downs	222
South-eastern Queensland	221
South Burnett	211
Upper Burnett	214
Atherton Tableland	232
Average for Queensland	220

The percentage of cows milking for the various lengths of lactation is shown in Table 1.

The objective should be to have cows in milk for ten months, with a dry period of two months before again freshening. This is not always possible where the bulls are not controlled, and in such cases it is not uncommon to have cows calving again within ten months.

The fact that 29.6 per cent. of the cows had lactation periods of 180 days or less calls for some action. It is pleasing to record that many of these animals have already been culled. In some instances the low lactation period may have been caused by sickness or accident, but in a large number of cases the cause was either an inherited tendency or a lack of feed. Where a short lactation period is inherited, the animals concerned should not be selected for breeding purposes, as the progeny will inherit this tendency.

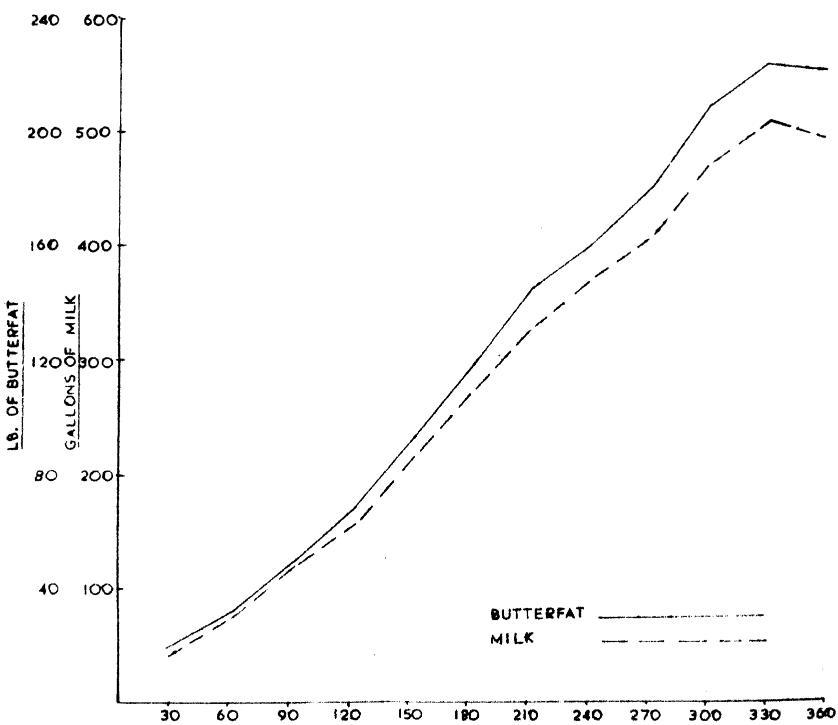


Plate 138.

Graph Showing Production of Butterfat and Milk According to Length of Lactation.

TABLE 1.

AVERAGE PRODUCTION ACCORDING TO LENGTH OF LACTATION.

District.	30 days.		60 days.		90 days.		120 days.		150 days.		180 days.		210 days.		240 days.		270 days.		300 days.		330 days.		360 days.	
	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.
	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.
All Queensland	387 (0·33)*	17	761 (1·25)	32	1,169 (2·46)	49	1,600 (4·56)	69	2,143 (8·04)	93	2,687 (13·01)	116	3,266 (18·57)	143	3,691 (19·74)	161	4,066 (26·21)	179	4,736 (2·47)	209	5,122 (1·31)	223	4,937 (2·04)	222
Sth-eastern Queensland	347 (0·29)	17	682 (1·25)	30	1,026 (2·57)	46	1,483 (4·5)	66	1,876 (8·03)	84	2,356 (12·96)	106	2,775 (18·52)	125	3,140 (20·16)	142	3,432 (25·12)	154	4,086 (2·60)	186	4,300 (1·39)	195	4,293 (2·60)	193
Darling Downs	354 (0·29)	14	878 (1·13)	35	1,355 (2·24)	54	1,790 (4·07)	76	2,464 (7·32)	105	3,162 (13·01)	134	3,931 (19·05)	171	4,518 (20·39)	192	4,957 (26·87)	217	5,716 (2·61)	246	6,301 (1·58)	267	6,750 (1·44)	301
South Burnett	453 (0·52)	17	726 (1·29)	30	1,176 (2·79)	50	1,573 (5·73)	65	2,261 (10·17)	90	2,754 (16·37)	112	3,354 (18·59)	139	3,653 (16·37)	149	4,059 (24·83)	169	4,652 (1·60)	197	5,248 (0·77)	219	4,438 (0·98)	197
Upper Burnett	603 (0·64)	21	958 (2·42)	37	1,610 (3·44)	60	1,918 (6·88)	81	2,705 (10·57)	114	3,317 (9·68)	132	4,116 (16·18)	169	4,566 (17·20)	192	4,530 (28·54)	195	6,239 (1·66)	275	6,439 (0·51)	246	5,843 (2·29)	263
Atherton Tableland	295 (0·32)	15	668 (0·85)	31	1,109 (1·06)	48	1,409 (3·29)	66	2,168 (5·41)	96	2,715 (9·24)	121	3,464 (18·47)	150	3,878 (21·55)	167	4,438 (33·86)	191	4,924 (3·08)	209	5,324 (0·85)	222	5,570 (2·02)	247

* The figures in brackets represent the percentage of cows in each case.

TABLE 2.

EFFECT OF MONTH OF CALVING ON AVERAGE PRODUCTION.

District.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.
	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.
All Queensland	2,883 (7·92)*	125	2,573 (4·90)	115	2,784 (3·82)	123	2,918 (3·65)	129	3,373 (3·48)	149	3,752 (4·76)	163	3,728 (7·46))	163	3,753 (9·73)	164	3,513 (13·30)	154	3,308 (15·34))	144	3,218 (14·06)	141	3,107 (11·57)	136
Sth-eastern Queensland	2,495 (8·11)	113	2,346 (4·89)	108	2,454 (3·73)	109	2,641 (4·04)	119	2,856 (3·42)	128	3,087 (4·59)	136	3,138 (7·14)	140	3,236 (8·76)	146	2,957 (13·07)	134	2,845 (15·74)	128	2,815 (14·67)	128	2,739 (11·83)	124
Darling Downs	3,403 (7·90)	145	3,180 (5·03)	141	3,293 (4·78)	145	3,608 (3·75)	159	4,074 (4·57)	180	4,688 (5·64)	205	4,638 (8·06)	202	4,406 (11·05)	191	4,311 (12·37)	187	4,034 (14·03)	169	3,845 (12·19)	165	3,668 (10·63)	157
South Burnett	2,830 (8·21)	116	2,234 (5·82)	92	2,330 (3·04)	98	2,585 (3·17)	108	3,536 (2·26)	153	3,738 (4·33)	152	3,369 (6·79)	144	3,856 (10·61)	160	3,498 (14·55)	145	3,188 (14·68)	135	3,122 (14·94)	125	2,981 (11·58)	125
Upper Burnett	2,862 (4·57)	116	1,956 (2·68)	84	3,353 (2·83)	141	2,950 (2·52)	128	3,624 (2·68)	148	4,387 (3·46)	184	4,200 (10·08)	175	4,062 (11·18)	169	4,398 (16·06)	184	3,915 (16·53)	164	3,899 (15·28)	161	3,113 (12·13)	128
Atherton Tableland	3,873 (8·32)	165	2,428 (4·34)	107	2,811 (1·88)	125	2,058 (1·41)	97	2,201 (1·29)	102	3,518 (3·63)	154	3,964 (6·57)	163	3,696 (9·03)	159	3,823 (15·71)	167	3,819 (18·76)	167	3,806 (15·47)	168	3,951 (13·60)	174

* The figures in brackets represent the percentage of cows in each case.

Effect of Length of Lactation on Production.

In order to emphasise the need to concentrate on cows with a normal lactation period, a survey of the average production of animals according to the length of the lactation period was made.

The results are shown in Table 1, and are also depicted in Plate 138.

It will be seen that there is a constant increase in production as the lactation period increases up to 330 days (11 months), thus indicating the need to maintain cows in milk for a long period during each lactation.

Effect of Month of Calving on Production.

A survey of the effect of month of calving on production, carried out on data available from the farmer's own sample recording scheme, was published in this Journal for March, 1948.

The information for the 1948-49 season is affected by (*a*) the season, and (*b*) the fact that in several groups the only figures available for some of the months are for cows with short lactation periods.

If all cows were fed adequately throughout the year, there should be little, if any, difference in production between cows calving in different months. However, to gain the maximum advantage under the conditions which exist generally, it will certainly pay to so regulate matings that cows calve in the third quarter of the year—that is, from July to September.

The effects of month of calving shown by the 1948-49 figures are similar to those obtained in the previous survey, except that in 1948-49 higher production was given by cows which calved in June to August, inclusive, compared with July to September in the previous survey. In 1948-49, cows calving between June and August produced 40 lb. butterfat more than cows calving in the first quarter of the year. Indeed, in one small area, where figures were available for a 20-month period, the increase was as much as 50 per cent. The Atherton Tableland results differed from those of other districts, as production was highest from cows which calved from September to December, but it must be pointed out that the Tableland experienced a much better season than usual, particularly during the spring months. This may have caused the production of cows which calved in these months to be higher than usual.

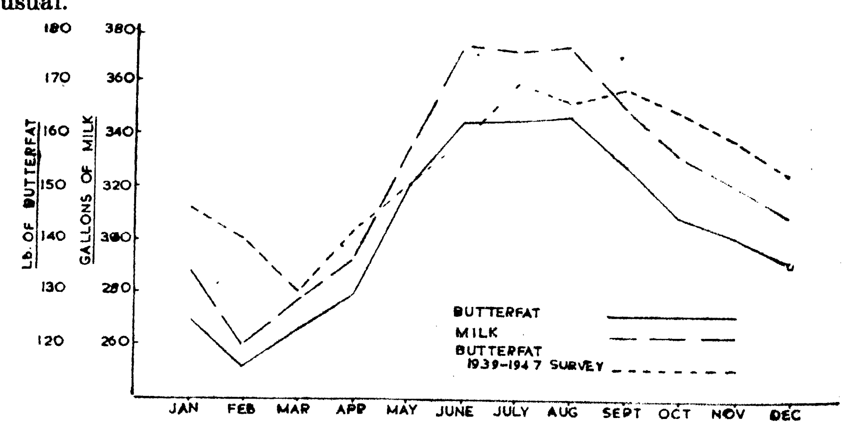


Plate 139.

Graph Showing the Effect of the Month of Calving on Production.

TABLE 3.

EFFECT OF MONTH OF CALVING ON AVERAGE LENGTH OF LACTATION.

District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	Period.	Period.	Period.	Period.	Period.	Period.	Period.	Period.	Period.	Period.	Period.	Period.
All Queensland	days. 192 (7·92)*	days. 185 (4·90)	days. 200 (3·82)	days. 218 (3·65)	days. 230 (3·48)	days. 239 (4·76)	days. 238 (7·46)	days. 235 (9·73)	days. 228 (13·30)	days. 216 (15·34)	days. 208 (14·06)	days. 200 (11·57)
South-eastern Queensland	190 (8·11)	187 (4·89)	204 (3·73)	225 (4·04)	231 (3·42)	241 (4·59)	241 (7·14)	238 (8·76)	229 (13·07)	215 (15·74)	210 (14·67)	199 (11·83)
Darling Downs	198 (7·90)	196 (5·03)	201 (4·78)	218 (3·75)	232 (4·57)	238 (5·64)	236 (8·06)	230 (11·05)	227 (12·37)	220 (14·03)	209 (12·19)	205 (10·63)
South Burnett	185 (8·21)	164 (5·82)	178 (3·04)	195 (3·17)	237 (2·26)	226 (4·33)	230 (6·79)	236 (10·61)	220 (14·55)	208 (14·68)	192 (14·94)	189 (11·58)
Upper Burnett	157 (4·57)	131 (2·68)	192 (2·83)	201 (2·52)	224 (2·68)	240 (3·46)	221 (10·08)	223 (11·18)	225 (16·06)	203 (16·53)	193 (15·28)	177 (12·13)
Atherton Tableland	209 (8·32)	171 (4·34)	195 (1·88)	168 (1·41)	172 (1·29)	259 (3·63)	249 (6·57)	244 (9·03)	240 (15·71)	233 (18·76)	226 (15·47)	227 (13·60)

* The figures in brackets represent the percentage of cows in each case.

TABLE 4.

AVERAGE PRODUCTION ACCORDING TO TEST RANGE.

District.	Under 3·0.		3·0–3·4.		3·5–3·9.		4·0–4·4.		4·5–4·9.		5·0–5·4.		5·5–5·9.		6·0–6·4.		6·5–6·9.		Over 7·0.	
	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.	Milk.	Fat.
	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.	gal.	lb.
All Queensland	2,310 (0·63)*	64	3,388 (6·55)	112	3,727 (20·97)	141	3,459 (28·98)	146	3,139 (20·24)	148	2,988 (14·35)	155	2,935 (5·69)	166	2,640 (2·05)	163	2,148 (0·40)	143	1,485 (0·13)	107
South-eastern Queensland	2,520 (0·44)	71	3,090 (5·36)	102	3,082 (15·56)	115	2,838 (26·91)	120	2,847 (24·49)	134	2,743 (18·13)	142	2,653 (6·54)	151	2,360 (2·0)	146	2,036 (0·41)	136	1,444 (0·15)	105
Darling Downs	2,093 (0·68)	57	3,746 (7·09)	124	4,353 (25·43)	164	4,260 (31·78)	178	3,932 (15·07)	185	3,710 (11·20)	193	3,601 (5·82)	204	3,149 (2·59)	194	2,963 (·27)	195	1,335 (0·06)	97
South Burnett	2,317 (1·60)	65	3,208 (10·74)	107	3,476 (31·49)	130	3,259 (29·48)	137	3,009 (14·25)	140	2,828 (8·0)	146	2,513 (2·58)	143	2,530 (1·34)	157	1,847 (0·36)	125	2,135 (0·15)	154
Upper Burnett	1,764 (0·84)	44	3,469 (7·39)	116	4,271 (28·54)	161	3,993 (31·72)	168	3,416 (19·87)	162	3,590 (8·66)	185	3,307 (1·91)	179	2,177 (0·89)	136	1,375 (0·38)	92	..	..
Atherton Tableland	3,135 (0·22)	89	4,327 (5·41)	141	4,607 (19·85)	173	4,131 (30·36)	173	3,317 (20·49)	156	2,803 (13·59)	146	2,730 (6·69)	155	2,157 (2·02)	133	1,938 (1·06)	129	1,160 (0·32)	83

* The figure in brackets represents the percentage of cows in each case.

Table 2 shows the average production of milk and butterfat, as well as the percentage of cows calving in each month, according to district. Plate 139 shows the production according to month for all recorded cows.

Effect of Month of Calving on Length of Lactation.

The average length of lactation of cows calving in the various months is shown in Table 3 and Plate 140.

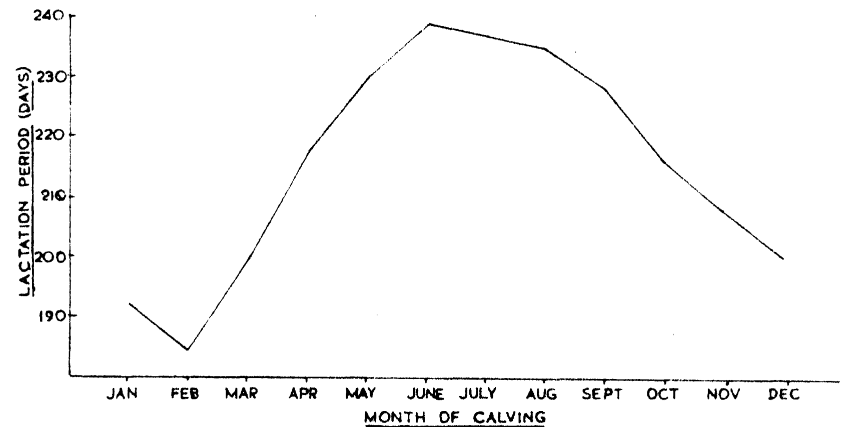


Plate 140.

Graph Showing the Effect of the Month of Calving on the Length of Lactation.

It will be noted that cows which calved during June to August in the season surveyed not only gave higher production but also milked longer.

Cows calving in June had an average lactation period of 239 days, compared with 185 days for cows which calved in February.

It would appear that cows which calved in June, July or August obtained the benefit of the flush growth of pasture after they had been milking from 5 to 6 months, and that this tended to prolong the lactation and increase production. On the other hand, cows which calved in January and February entered a dry period, with pastures low in nutritive value, after milking for six months, and this hastened the end of the lactation period.

Table 3 also shows the percentage of cows which calved in each month.

Relationship of Test to Production.

Most dairy farmers in Queensland supply butter or cheese factories and payment for their produce is based on the quantity of butterfat supplied. The amount of butterfat produced, therefore, is of more importance in these cases than the amount of milk.

The survey of the 1948-49 figures was carried out without considering breed, but henceforth the work will be done on a breed basis.

Table 4 shows the average production of milk and butterfat of cows within the various test ranges, and the percentage of cows in each range. The trend is also illustrated in Plate 141.

It will be noted that the highest average yield of milk (352 gallons) was found in the test range of 3.5-3.9 per cent., while the highest average yield of butterfat (166 lb.) occurred in the 5.5-5.9 per cent. range.

Work done by the New Zealand Dairy Board has shown that, within breeds, there is a strong correlation between butterfat test of the milk and the total yield of butterfat, and the conclusion has been drawn that to raise the level of butterfat production farmers should endeavour to breed from families which combine better-than-average tests with high milk yield.

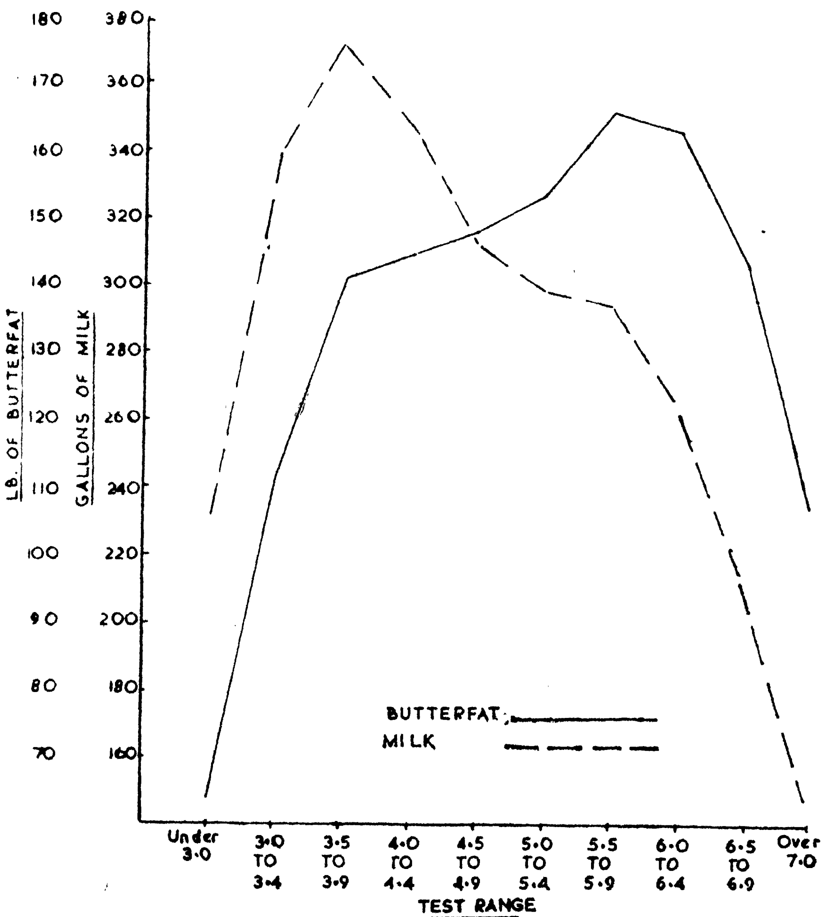


Plate 141.

Graph Showing the Relationship Between Butterfat Test and Production.

WATCH FOR HEMLOCK WEED.

The poisonous hemlock weed has been reported from the Mt. Sylvia area in the Lockyer, and farmers on creeks draining into the Brisbane River are advised to keep a watch for any unusual plant springing up on their properties. Hemlock can be distinguished by its large, green, carrot-like leaves and its white, parsnip-like taproot.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock, which qualified for entry into the advanced register of the A.I.S., Jersey, Guernsey, Ayrshire, and Friesian Societies' Herd Books, production records for which were compiled during the months November and December, 1949, and January and February, 1950 (273 days unless otherwise stated). The records have been calculated to the nearest pound.

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW (STANDARD 350 LB.).				
Jamberoo Marjorie 10th	Hart Bros., Clifton	12,751	520	Murray Bridge Florrie's Prince
Highfields Ethel 4th	R. A. and N. K. Shelton, Hivesville	13,032	467	Berry Trenton
Eachamvale Queen	J. K. English and Sons, Malanda	11,294	457	Eachamvale Standard
Arolla Lady Sal	A. F. Campbell, Killarney	10,411	382	Parkview Highbrow
Navillus Showgirl 4th	C. O'Sullivan, Greenmount	19,322	709	Greyleigh Eros
Glenroy Enid	W. F. Kajewski, Glencoe	8,944	396	Blacklands Sheik
Alfa Vale Eveline 11th	W. H. Thompson, Nanango	8,589	377	Alfa Vale Stalin
Alfa Vale Gentle 11th	W. H. Thompson, Nanango	11,327	559	Alfa Vale Pat
Lynfield Golden 2nd	F. E. Birt, Sexton	12,312	526	Parkview Ransom
Dorravista Beauty	H. A. Turner, Tarzali	11,304	503	Evansvale Eclipse
Blacklands Lady Gentle 14th	Estate P. Doherty, Gympie	10,925	484	Blacklands Czar
Tara Cleo 3rd	Mrs. K. Henry, Greenmount	9,215	432	Tara Magnet's Gift
White Park Pendant 27th	J. Coonan, Cambooya	9,101	388	Karawarra Standard
Tara Magnet 3rd	Mrs. K. Henry, Greenmount	9,837	336	Alfa Vale Plumber
Calrossie Empress 5th	W. D. Davis, Chinchilla	8,778	372	Ehlma Park Bosca
Tara Laura 7th	Mrs. K. Henry, Greenmount	9,412	369	Tara Osiris
Yarranvale Gentle	W. D. Davis, Wamba	8,489	367	Trevor Hill Bosca
Bunya View Thelma 5th	G. Sperling, Kooralgin	9,179	363	Trevor Hill Perfection
Tara Cinderella 2nd	Mrs. K. Henry, Greenmount	7,898	355	Alfa Vale Plumber
SENIOR, 4 YEARS (STANDARD 330 LB.).				
Corunna Isabel (239 days)	K. A. Ruhle, Motley	9,007	388	Fairvale Duncan
Glenroy Princess	W. F. Kajewski, Glencoe	8,034	382	Blacklands Sheik
Bunya View Scarlet 2nd (365 days)	Edwards Bros., Kingaroy	13,386	611	Trevor Hill Reflection
Glenroy Birdie	W. F. Kajewski, Glencoe	9,752	434	Blacklands Sheik
Springleigh Buttercup 32nd	H. F. Moller, Boonah	8,045	370	Blacklands Melba's Pride
JUNIOR, 4 YEARS (STANDARD 310 LB.).				
Learmont Lovely	P. J. Donaghy and Son, Malanda	8,485	428	Alfa Vale Pride 18th
Sydmouth Blossom	T. Vayro, Flagstone Creek	8,918	347	Navillus Paros
Blacklands Ethel 32nd	A. Pickels, Proston	9,261	384	Blacklands Maiden's Monarch
SENIOR, 3 YEARS (STANDARD 290 LB.).				
Learmont Shiny	P. J. Donaghy and Son, Malanda	11,140	488	Sunnyview Melba's Hero
Fernhome Bonnie	R. S. Griffiths, Moregatta	8,508	387	Glengarry's Gem Royal
Bantry Nellie 2nd	D. Sullivan, Rossvale	8,808	347	Rosenthal Surplus 2nd
Glen Idol Countess 7th	Estate P. Doherty, Gympie	7,611	321	Blacklands True Blue
Navillus Countess 5th (239 days)	C. O'Sullivan, Greenmount	11,728	465	Parkview Limerick
Glenroy Jane	W. F. Kajewski, Glencoe	7,233	334	Fairholm Lewis
Tara Cleo 5th	Mrs. K. Henry, Greenmount	7,076	327	Alfa Vale Plumber
Dorravista Dot (231 days)	H. A. Turner, Tarzali	6,973	327	Learmont Byron
Dorravista Annie 5th (234 days)	H. A. Turner, Tarzali	6,826	315	Learmont Byron
Tara Isis 6th	Mrs. K. Henry, Greenmount	8,108	304	Alfa Vale Plumber

JUNIOR, 3 YEARS (STANDARD 270 LB.).

Penrhos Sally 4th	A. Sandilands, Wildash	6,886	308	Rosenthal Macarthur
Sunnyview Roan Fairest	A. Lohse, Degilbo	8,233	294	Newstead Ambassador
St. Andrew's Violet	M. C. Lester, Glengallan	10,682	471	Bingleigh Premier
Yarranvale Tot	K. Berghofer, Athol	7,187	320	Sunnyview Royal National
Merridale Dell 2nd	Giles Bros., Woowoonga	8,067	309	Blacklands Oxford
Learmont Young Posey	P. J. Donaghy and Son, Malanda	7,249	296	Alfa Vale Pride 18th
Learmont Dolly	P. J. Donaghy and Son, Malanda	6,421	275	Alfa Vale Pride 18th
Glen Idol Florrie 17th	Estate P. Doherty, Gympie	9,790	382	Blacklands True Blue
Cedargrove Lady Prim 21st	F. Derrick, Monto	8,324	342	Rosenthal Scout
Cedargrove Wonder 44th	F. Derrick, Monto	8,792	340	Rosenthal Scout
Tara Isis 8th	Mrs. K. Henry, Greenmount	7,722	337	Alfa Vale Plumber
Cedargrove Strawberry 21st	F. Derrick, Monto	7,343	312	Rosenthal Scout

SENIOR, 2 YEARS (STANDARD 250 LB.).

Valera Bonny 14th	Sullivan Bros., Pittsworth	9,222	383	Alfa Vale Pride 2nd
Learmont Poppy	P. J. Donaghy and Son, Malanda	9,359	344	Sunnyview Melba's Hero
Bunyaview Queenie	A. E. Powell, Chinchilla	9,037	321	Trevor Hill Progress
Blacklands Lady Jean 30th	A. Pickels, Proston	8,796	303	Blacklands Maiden's Monarch
Cloverdale Dove 2nd	A. E. Powell, Chinchilla	8,227	298	Haroldale Barrister
Glen Idol Lady Gentle	Estate P. Doherty, Gympie	8,645	298	Glen Idol Charmer
Valera Dahlia	Sullivan Bros., Pittsworth	6,562	294	Alfa Vale Pride 2nd
Sydmouth Una 2nd	T. Vayro, Flagstone Creek	6,943	292	Navillus Paros
Blacklands Ethel 37th	A. Pickels, Proston	6,977	250	Blacklands Gloucester
Millievale Charlotte 2nd	A. H. Webster, Helidon	10,066	418	The Corals, Gold Standard
St. Andrew's Gem 10th	M. C. Lester, Glengallan	8,685	350	Tabbagong Victory
Glenroy Bangle	W. F. Kajewski, Glencoe	7,696	333	Cosey Camp Ida's Patron
Glenroy Eleanor	W. F. Kajewski, Glencoe	7,124	313	Fairholm Lewis
Glenroy Minnie	W. F. Kajewski, Glencoe	7,176	310	Fairholm Lewis
Glenroy Bloss	W. F. Kajewski, Glencoe	5,474	295	Fairholm Lewis
Glenroy Eunice	W. F. Kajewski, Glencoe	6,073	285	Fairholm Lewis
Fairvale Dulcie 10th	K. A. Ruhle, Motley	6,374	285	Fairvale Dairy Lad
Glenroy Sally 2nd	W. F. Kajewski, Glencoe	5,984	273	Fairholm Lewis
Glenroy Eileen	W. F. Kajewski, Glencoe	5,809	269	Fairholm Lewis
Glenroy Pearl	W. F. Kajewski, Glencoe	6,252	268	Fairholm Lewis
St. Andrew's Gem 11th	M. C. Lester, Glengallan	8,333	318	Tabbagong Victory
Springleigh Mavis 8th	H. F. Moller, Boonah	7,189	315	Blacklands Melba's Pride
Blacklands Carnation 17th	A. Pickels, Proston	6,723	270	Blacklands Gloucester
Kulpi Lovely	H. L. and C. I. Bruggemann, Kulpi	7,020	270	Fairvale Ethel's Monarch

JUNIOR, 2 YEARS (STANDARD 230 LB.).

Learmont Pearl	P. J. Donaghy and Son, Malanda	7,094	291	Alfa Vale Pride 18th
Glen Idol Thelma 11th	Estate P. Doherty, Gympie	7,365	274	Glen Idol Charmer
Meadowvale Gold 31st	O'Connor Bros., Colinton	6,552	274	Parkdene Major
Bantry Model 3rd	D. Sullivan, Pittsworth	6,415	263	Bantry Commodore
Kulpi Jean 2nd	H. L. and C. I. Bruggemann, Kulpi	6,566	259	Fairvale Ethel's Monarch
Ardilea Mayflower	Hinrichsen and Sons, Clifton	5,169	236	Ardilea Socialist
Tara Cleo 6th	K. Henry, Greenmount	7,109	298	Alfa Vale Plumber
Millievale Cora 4th	A. H. Webster, Helidon	7,092	275	Alfa Vale Pride
Ripley Park Sweet Brier	I. B. Skerman, Kaimkillenbun	6,854	272	Trevor Hill Reflection
St. Andrew's Gem 19th	M. C. Lester, Glengallan	9,852	338	Tabbagong Victory
Applegarth Mavis 8th	F. Derrick, Monto	8,705	316	Fairholm Evidence
Blacklands Buttercup 17th	A. Pickels, Proston	8,558	311	Parkview Alexander
St. Andrew's Envy	M. C. Lester, Glengallan	7,920	305	Tabbagong Victory
Navillus Carnival's Plum 8th	C. O'Sullivan, Greenmount	6,971	300	Navillus Carnival
Spring Valley Dahlia	Edwards Bros., Kingaroy	8,509	299	Aynesley Charmer
St. Andrew's Gentle	M. C. Lester, Glengallan	7,517	296	Tabbagong Victory
Glenroy Show Lass	W. F. Kajewski, Glencoe	6,072	285	Fairholm Lewis
Kulpi Tulip 2nd	H. L. and C. I. Bruggemann, Kulpi	6,646	245	Fairvale Ethel's Monarch

PRODUCTION RECORDING—*continued.*

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	JERSEY.			
	MATURE COW (STANDARD 350 LB.).			
Nairfale Princess Beth (305 days)	R. J. Browne, Yangan	9,460	504	Nairfale Noble Count
Nairfale Princess Beth	R. J. Browne, Yangan	8,593	460	Nairfale Noble Count
Fauvic Marmay (365 days)	S. A. Cramb, Noosa Heads	10,252	512	Condong Marabean
Glenrandle Dairymaid	P. Kerlin, Killarney	7,440	453	Bellgarth Stylish
Lermont Brightgirl	J. Schull, Oakey	5,493	351	Selsey Samares Hallmark
Nairfale Princess Beth (365 days)	R. J. Browne, Yangan	10,931	584	Nairfale Noble Count
Trinity Crowning Meadowsweet	D. J. Louttit, Monto	9,173	479	Trinity Crowning Effort
Trinity Cute Daffodil 2nd	J. McCarthy, Greenmount	7,355	464	Samares Cute Prince 3rd (imp.)
Glenview Brittannia	D. J. Louttit, Monto	8,490	459	Trinity Governor's Hope
Hazeldean Springtime	D. J. Louttit, Monto	8,232	413	Glenview Crusader
Glenrandle Fashion Lady	P. Kerlin, Killarney	6,416	361	Bellgarth Stylish
	SENIOR, 4 YEARS (STANDARD 330 LB.).			
Gem Dolores	W. Bishop, Kenmore	8,490	386	Bulby Oxford Gamboge
	JUNIOR, 4 YEARS (STANDARD 310 LB.).			
Palen Bluebell 2nd	H. M. Prison Farm, Palen Creek	6,481	313	Westbrook Ambassador 51st
Glenrandle Spotted Lady	P. Kerlin, Killarney	7,321	436	Oxford Noble Peer
Ashview Locket 3rd	C. Huey, Sabine	8,290	434	Trecarne Victor 4th
	SENIOR, 3 YEARS (STANDARD 290 LB.).			
Bellgarth Bluebird	P. Kerlin, Killarney	5,653	327	Bellgarth Victory
Gunawah Skylark	R. D. Johnston, Kingaroy	7,543	368	Austral Park Montrose Blue
	JUNIOR, 3 YEARS (STANDARD 270 LB.).			
Nairfale Coquette (365 days)	R. J. Browne, Yangan	7,068	374	Kelvinside Handsome Boy
Nairfale Comedy's Design (305 days)	R. J. Browne, Yangan	5,626	315	Kelvinside Handsome Boy
Tarana Lady Nell	J. F. Lovell, Samford	5,984	281	Lermont Golden Victory
Bellgarth Royal Lady	D. R. Hutton, Cunningham	6,300	366	Romsey Spotted King
Nairfale Comedy's Design	R. J. Browne, Yangan	6,135	346	Kelvinside Handsome Boy
Viewmont Lady Evelyn	M. L. Massam, Beaudesert	5,458	290	Windsor Sultan Leslie
Sunny Glen Nellie	J. McCarthy, Greenmount	5,867	364	Ivy Bank Lad
Glenrandle Chimes	P. Kerlin, Killarney	6,703	336	Bellgarth Glory King 2nd
Lermont Pride	J. Schull, Oakey	6,050	326	Trinity Graceful Duke
Gem Naomi	W. Bishop, Kenmore	6,730	309	Trinity Cute Effort
Kathleigh Soya 2nd	C. W. Barlow, Boodua	5,344	306	Oxford Fawn's Noble
	SENIOR, 2 YEARS (STANDARD 250 LB.).			
Benvue Betty	R. W. Webb, Stafford	6,988	336	Navua Royalist Prince
Bellgarth Golden Gwen	D. R. Hutton, Cunningham	5,787	294	Trinity Gleaming Effort
Connemara Fancy Dress	J. Ahern, Conondale	4,182	286	Glenview Lochiel
Silverbrook Mable 2nd	J. Schull, Oakey	5,248	279	Trinity Noble Effort
Myrtledale Sweet Marie (244 days)	H. Sigley, Jaggan	6,257	361	Palm Ridges Golden Victory
Boree Effort's Auriel (305 days)	G. and V. Beattie, Antigua	6,508	303	Trinity Daffodil's Effort

Lermont Connie	J. Schull, Oakey	5,076	280	Trinity Graceful Duke
Boree Effort's Auriel	G. and V. Beattie, Antigua	5,777	267	Trinity Daffodil's Effort
Lermont Gentle 4th	J. Schull, Oakey	4,309	263	Trinity Graceful Duke
Parkview Merry Maiden	H. T. W. Barker, Oakey	5,215	259	Brookland Merry Cavalier
Ashview Queen 3rd	C. Huey, Sabine	5,226	256	Trecarne Victor 4th
Boree Cute Charming	W. and C. E. Tudor, Gayndah	7,003	380	Trinity Cute Commodore
Tecoma Success	A. Semgreen, Coolabunia	8,588	361	Austral Park Double Blue
Carnation Felicity	Queensland Agricultural High School and College, Lawes	7,172	360	Oxford Fawn's Victor
The Lodge Sadie	W. Bishop, Kenmore	7,462	331	Gem Loyal Highness
Gem Alexia	W. Bishop, Kenmore	6,366	326	Bulby Maria's Keepsake
Westbrook Tulip 148th	Farm Home for Boys, Westbrook	6,355	322	Westbrook Comet 17th
Westbrook Bells 18th	Farm Home for Boys, Westbrook	5,693	310	Westbrook Comet 17th
Glenrandle Brown Maid	P. Kerlin, Killarney	6,232	298	Waltham Farm Brown Boy
College Fleur 7th	Queensland Agricultural High School and College, Lawes	6,094	272	Westbrook Ambassador 52nd
Bona Vista Roselie	D. R. Hutton, Cunningham	4,426	253	Belgonia Standard
Bellgarth Lady Gleam	D. R. Hutton, Cunningham	4,599	250	Trinity Gleaming Effort

JUNIOR, 2 YEARS (STANDARD 230 LB.).

Westwood Courtship	F. Porter, Cambroon	5,549	310	Devon Park Madeira's Victorious
Romsey Brown Lady	J. Wilton, Killarney	5,189	286	Oxford Flying Fox
Westwood Nita	F. Porter, Cambroon	4,447	276	Devon Park Madeira's Victorious
Tarana Lady Au-Lynne	J. F. Lovell, Samford	5,214	272	Oxford Bruno
Romsey White Rose	J. Wilton, Killarney	5,252	271	Oxford Flying Fox
Romsey Larkspur's Pride	J. Wilton, Killarney	5,086	261	Oxford Flying Fox
Glenrandle Joan	P. Kerlin, Killarney	7,048	387	Gem Rodney
Glenrandle Winsome Lady	P. Kerlin, Killarney	6,021	364	Gem Rodney
Glenrandle Fair Lassie 2nd	P. Kerlin, Killarney	5,452	337	Gem Rodney
Glenside Ivy 2nd	Queensland Agricultural High School and College, Lawes	4,997	302	Oxford Dudley
Burnlea Matilda 2nd	A. E. Trigger, Didcot	4,970	253	Yuruga Golden Noble
Westbrook Sylvia 26th	Farm Home for Boys, Westbrook	6,473	296	Mornmoot Clementine's Valour
Glenrandle Evenbelle 2nd	P. Kerlin, Killarney	5,239	282	Gem Rodney
Westbrook Silvermine 3rd	Farm Home for Boys, Westbrook	5,735	278	Westbrook Comet 26th
Ashview Ladyette 2nd	C. Huey, Sabine	5,567	276	Trecarne Some Tot's Duke 2nd
Westbrook Sylvia 27th	Farm Home for Boys, Westbrook	6,093	276	Westbrook Silvermine's Valour
Bellgarth Fairy 6th	D. R. Hutton, Cunningham	4,498	276	Trinity Gleaming Effort
Ashview Queen 4th	G. Ralph, Ravensbourne	5,592	256	Trecarne Victor 4th
Grasmere Sam's Tulip	W. Bishop, Kenmore	4,528	242	Navua Victorious Samaritan
Westbrook Wyndotte 11th	Farm Home for Boys, Westbrook	4,523	230	Westbrook Silvermine's Valour

FRIESIAN.

JUNIOR, 2 YEARS (STANDARD 230 LB.).

Yarrabine Dell	C. H. Naumann, Yarraman	6,556	233	St. Athans Belle Piebe 3rd

GUERNSEY.

MATURE COW (STANDARD 350 LB.).

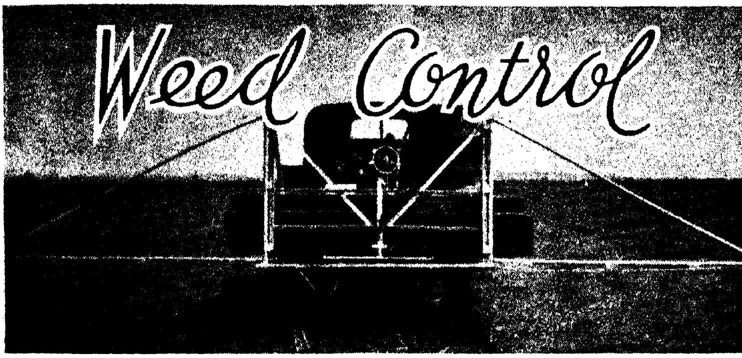
Evermore Josie	J. Murdock and M. J. Wrigley, Preston	5,834	361	Yarraview Commander
Adaville Olwyn	H. Sanderson, Monto	7,477	391	Fernhill Rose Boy
Evermore Tess	J. Murdock and M. Wrigley, Preston	6,054	387	Yarraview Commander
Evermore Maytime	J. Murdock and M. Wrigley, Preston	5,738	376	Yarraview Commander
Fernhill Golden Laurel	D. C. Johnston, Beaudesert	8,303	400	Cooroora View Pilgrim

SENIOR, 4 YEARS (STANDARD 330 LB.).

Oakwood Biddy	D. C. Johnston, Beaudesert	7,650	372	Fairfield Winner
Adaville Olive	J. M. Cooke, Witta	6,793	351	Laureldale Pluto

PRODUCTION RECORDING—*continued.*

Animal.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	JUNIOR, 4 YEARS (STANDARD 310 LB.).			
Oakwood Fay (amended)	G. Miller, Chambers Flat	6,829	317	Fairfield Winner
	SENIOR, 3 YEARS (STANDARD 290 LB.).			
Oakwood Pam (amended)	D. C. Johnston, Beaudesert	8,614	376	Fairfield Winner
Evermore Merle	J. Murdock and M. J. Wrigley, Preston	4,700	317	Yarraview Commander
	JUNIOR, 3 YEARS (STANDARD 270 LB.).			
O Kay Hollyhock	H. Sanderson, Monto	6,261	312	Linwood Goldfinder
Linwood Sonia	E. G. Foxton, Maleny	5,882	279	Wirrawong Winter
	JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Toba Marie	E. G. Foxton, Maleny	6,379	281	Wirrawong Winter
Toba Bettina	E. G. Foxton, Maleny	5,021	250	Koojan Ace's Marshall
Toba Pansy	E. G. Foxton, Maleny	4,817	241	Linwood Hurricane
Fernhill Peacebelle	D. C. Johnston, Beaudesert	5,771	312	Wollongbar Remus
Toba Brightly	D. C. Johnston, Beaudesert	6,634	307	Linwood Hurricane
	AYRSHIRE.			
	MATURE COW (STANDARD 350 LB.).			
Eleresley Josephine	Stimpsons Ltd., Loganlea	10,592	437	Benbecula Banker
	JUNIOR, 4 YEARS (STANDARD 310 LB.).			
Crescent Farm Joyous	N. J. Mann, Broxburn	10,848	411	Myola Orphan Boy
	SENIOR, 3 YEARS (STANDARD 290 LB.).			
Leafmore Bonnie's Queen	J. P. Ruhle, Motley	6,872	296	Leafmore Jerrard
	JUNIOR, 3 YEARS (STANDARD 270 LB.).			
Benbucula Thistledown	L. Holmes, Yarranlea	7,544	283	Benbecula Marquis
	SENIOR, 2 YEARS (STANDARD 250 LB.).			
Crescent Farm Monnie	N. J. Mann, Broxburn	9,683	415	Myola Orphan Boy
Crescent Farm Pussy	N. J. Mann, Broxburn	7,259	277	Myola Orphan Boy
	JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Crescent Farm Annabelle	N. J. Mann, Broxburn	9,964	359	Myola Orphan Boy
Leafmore Lady Vee	J. P. Ruhle, Motley	5,838	242	Myola Jaunt 2nd
Benbecula Tranquil	L. Holmes, Yarranlea	7,614	310	Benbecula Marquis
Crescent Farm Venice	N. J. Mann, Broxburn	7,755	286	Crescent Farm Bell Boy
Leafmore Vestage	J. P. Ruhle, Motley	5,982	273	Myola Perfection
Leafmore Handsome 2nd	J. P. Ruhle, Motley	6,154	262	Myola Perfection
Auchen Eden Bessie	J. N. Scott, Camp Mountain	5,867	245	Oaklands Duke



A Boom Spray for Weed Control.

IN the March issue of this Journal, four spraying units used for weed control purposes were described and illustrated. These were the "Marino," "P.M.S.," "Wilmist," and "Buzacott-Wolseley" sprayers.

The "Klean Krop" boom spray is now available in Queensland and is illustrated in Plates 142 to 144

This outfit consists of a 1.2 h.p. air-cooled engine, gear pump, 20-gallon metal tank, and brass boom. The pump is fitted with a relief valve and pressure gauge and is capable of delivering two gallons per minute at 100 lb. pressure. Lower pressures can be obtained by adjusting the relief valve. The boom is in lengths of six feet and its height above the crop is adjustable. Nozzles delivering a cone spray are spaced at 14-inch intervals. A control cock and a gauge filter for the booms are fitted.

The manufacturers state that at a vehicle speed of 4 m.p.h. the rate of application at 25 lb. pressure is 4 gallons per acre; at 50 lb., 5 gallons; and at 100 lb., 7 gallons.

Plate 142.

Boom Spray in Operation.

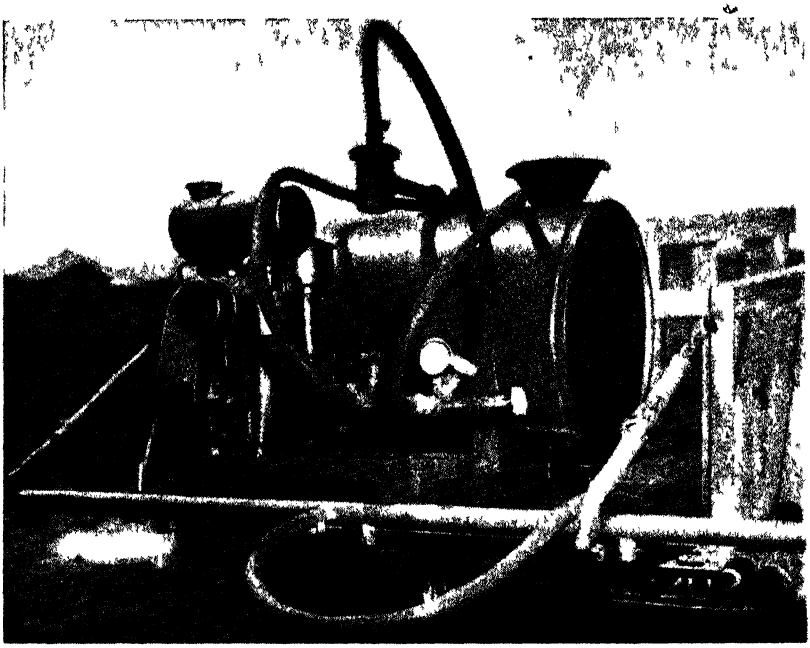


Plate 143
View of Outfit on a Utility Truck.

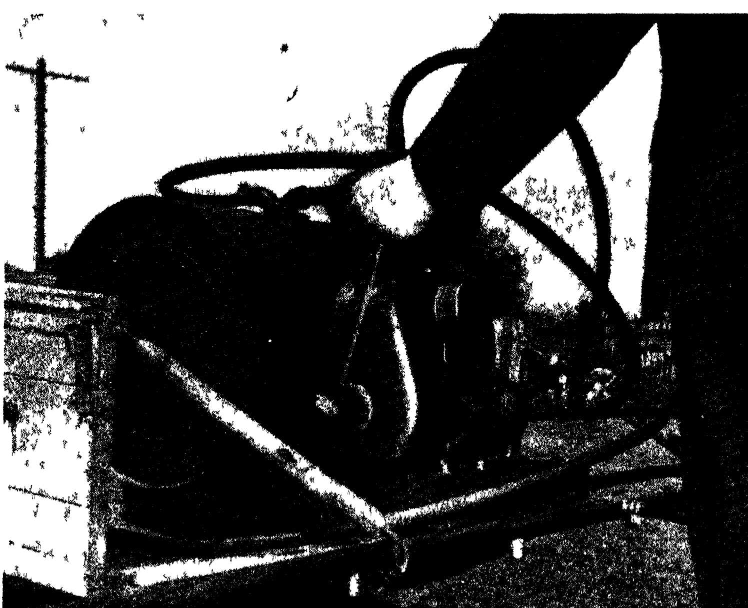


Plate 144
Starting the Motor.

A Baby "Talks" on "Crying."

IF you are one of these parents who are nearly driven to distraction by a baby who cries most of the day and night, take heart, for your misery and the baby's is usually preventable and easily remedied.

First of all you must remember that a baby's cry is his only method of expression and sometimes he has so much to say to parents who do not seem to understand! Moreover, that which he has to say (by crying) is nearly always worth saying and worth taking note of, for young infants are too innocent and guileless to cry just for the "heck of it" or merely to annoy their parents, although some crying of course is quite natural and healthy.

Let us now consider some of the things that baby is frantically trying to say. Let baby speak for himself: "I'm terribly hungry and you have no idea how painful it is to be kept waiting. Bother the clock on the wall, I'm the best judge of when I'm hungry. I want more to eat—how can a chap be expected to be a lawful citizen, to do his daily kicks, play, grow and gain weight on insufficient food? I can't even sleep because hunger pains are very painful to me. But don't try and fill me too full because that's just as painful. When I indicate that I've had enough, I've usually had enough and it's no earthly good trying to force me to take more. It will only make matters worse and then we will all get upset. And remember, a chap's appetite varies on occasions, especially when he's feeling a bit 'off,' or is over-tired, or teething, or over-excited or it's terribly hot. Please make allowances and don't try to regiment me too much, I'm a pretty wise guy when it comes to regulating my own diet."

"Most important, too, never neglect to give my 'wind' a chance to come up after a feed. It may take some time and patience but it's usually worth it. If you lay me down with the 'wind' still inside, it gives me dreadful tummy-ache and you will just get your deserts if I scream the roof down!"

"Now, just in case you may think I'm a typical male, always thinking of my stomach, I'll explain a few more things I may have occasion to tell you in a high pitched voice:

"I've got a wet or soiled nappy and it's most uncomfortable and certainly not conducive to sleep. In fact I'll be blowed if I'll settle down until I'm cleaned up and changed. Again, I may be too hot or too cold and generally uncomfortable, or I may be thirsty or over-tired. I'm really sorry to have to bother you, but I'm so weak and helpless without your loving care. However, I'm not a block of wood, I'm a living human being with as keen feelings and sensations as you have. All I ask is to be changed, made comfortable and tucked in again. Of course, a little cuddle, a few reassuring words and a smile always gives me a warm feeling of security inside and never do me any harm. But don't take me up and nurse me in the middle of the night nor take me into the warmth of your own bed or I may come to expect this 'spoiling' and give you a terrible time if I don't get it."

"However, during the day, things are different and I may have good reason to complain in no uncertain voice that I'm being neglected, I'm lonely and I'm bored. Sometimes, I'm left lying down in my pram outside for many hours a day, often without any toys and no one to take any interest in me. I know you are very busy washing my 'naps,' &c., but please don't leave me alone with nothing to do for too long or I shall get miserable and cross. I like to be talked to occasionally, and cuddled and played with, for then I know that you love me and that I'm wanted and secure. And when I get a bit older I like to sit up for a bit to watch all the interesting things that are going on around me—only thus can I broaden my horizon and gain a knowledge of my identity in the scheme of things. Again, when I reach the stage of crawling and walking please give me a chance to try out and practise these maturing abilities."

"Now, seeing that I am really getting things off my chest, I'm going to tell you another thing that upsets and distresses me and that is family disharmony. You would be surprised how keenly I can sense the tension in the air, apart from the shouting and the noise which makes open warfare obvious! I know very well when Mum and Dad are over-tired, worried, anxious, nervous and fretful and I'm afraid it just makes me the same way. I know it only makes matters worse but I'm such a small little baby and so dependent on you grown-ups for my happiness and security, so please try to be calm, cheerful and at peace with the world. It makes everything so much more pleasant and easy for everyone."

"You will be glad to hear that I can't think of anything else that makes me cry unduly, at the moment, except of course illness and real physical pain, such as I sometimes get when teething. But when I am really ill there will usually be some other symptoms and signs and then you should not hesitate to send for the doctor. I'm too precious to be treated by Grandma, Mum-in-law or the Neighbours and beware of some of the old-fashioned traditional remedies like castor oil. They often do more harm than good."

Any further information on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's Terrace, Brisbane, or by addressing letters "Baby Clinic, Brisbane." These letters need not be stamped.

ASTRONOMICAL DATA FOR QUEENSLAND.

OCTOBER.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Date.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	5·29	5·47	Cairns	37	21	Longreach ..	32	31
6	5·23	5·49	Charleville .. .	28	26	Quilpie	34	36
11	5·18	5·52	Cloncurry	55	44	Rockhampton ..	14	7
16	5·13	5·55	Cunnamulla ..	29	30	Roma	18	16
21	5·07	5·58	Dirranbandi	18	20	Townsville ..	31	18
26	5·03	6·01	Emerald	23	15	Winton	44	35
31	5·00	6·04	Hughenden ..	40	29	Warwick	3	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Date.	Rise.	Set.
	p.m.	a.m.
1	10·26	8·02
2	11·22	8·44
3	..	9·31
	a.m.	
4	12·15	10·24
5	1·05	11·20
		p.m.
6	1·50	12·20
7	2·31	1·22
8	3·08	2·23
9	3·43	3·25
10	4·16	4·29
11	4·49	5·34
12	5·24	6·41
13	6·02	7·52
14	6·46	9·04
15	7·37	10·15
16	8·34	11·21
17	9·38	..
		a.m.
18	10·44	12·20
19	11·49	1·10
	p.m.	
20	12·52	1·51
21	1·52	2.28
22	2·49	2·59
23	3·44	3·28
24	4·37	3·56
25	5·31	4·24
26	6·26	4·54
27	7·22	5·26
28	8·18	6·01
29	9·14	6.41
30	10·08	7·26
31	10·58	8·17

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	10	29	25	44	0	20	27	52
6	10	29	26	44	0	19	28	52
11	20	16	36	32	11	8	42	36
16	30	8	46	23	21	0	54	25
21	24	13	40	29	15	3	46	32
26	13	24	28	40	3	16	32	47
31	9	31	25	46	0	22	26	54

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Date	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	5	52	35	65	19	50	5	44
3	2	55	33	67	17	52	3	45
5	2	56	33	67	17	53	3	46
7	10	49	37	63	22	49	9	41
9	20	36	43	55	28	44	17	31
11	32	23	52	45	36	30	26	20
13	44	10	61	37	45	23	37	10
15	54	2	67	32	51	17	44	3
17	56	3	68	32	52	18	46	4
19	51	6	65	34	49	20	42	7
21	40	14	57	40	42	25	33	14
23	29	26	50	47	35	33	25	22
25	19	37	42	56	27	41	17	32
27	9	46	37	61	21	47	8	38
29	2	53	33	66	17	51	3	44
31	2	57	33	68	17	53	3	47

Phases of the Moon.—Last Quarter, October 4, 5.53 p.m.; New Moon, October 11, 11.33 p.m.; First Quarter, October, 18, 2.18 p.m.; Full Moon, October 26, 6.46 a.m.

On 15th October the Sun will rise and set about 10 degrees south of true east and true west respectively, and on the 11th and 23rd the Moon will rise and set at true east and true west respectively.

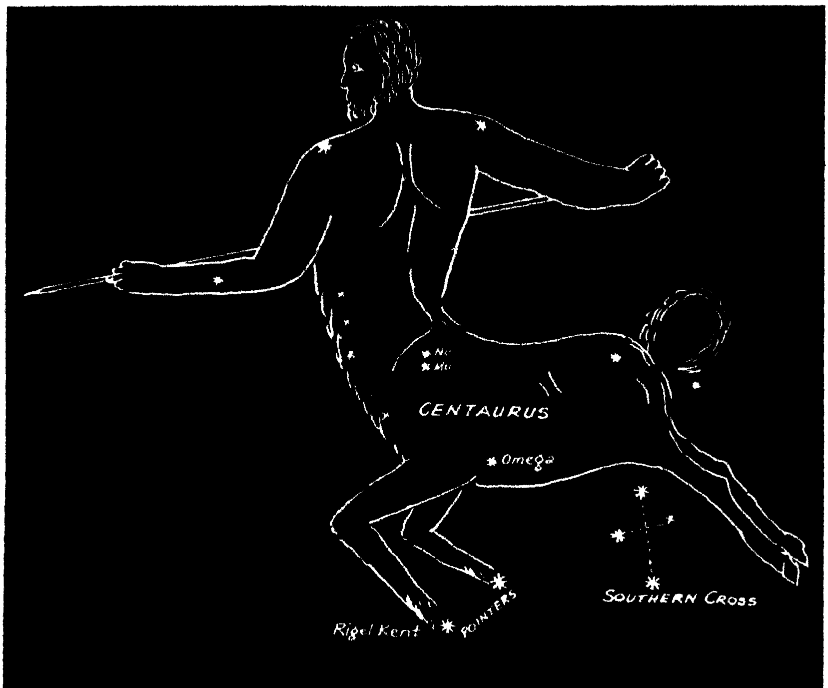
Mercury.—Not suitably situated for observation during this month, though on the 1st, in the constellation of Leo, will rise 45 minutes before the Sun, reaching greatest angle west of the Sun on the 3rd. On the 6th it will pass from west to east of Saturn, and by the end of the month, in the constellation of Virgo, will be in line with the Sun.

Venus.—Now too close in line with the Sun for observation.

Mars—At the beginning of October, in the constellation of Scorpio, will set between 10.8 p.m. and 11.15 p.m., the Moon passing close on the 15th. By the end of the month, in the constellation of Ophiuchus, will set between 9.50 p.m. and 10.15 p.m.

Jupiter.—In the constellation of Aquarius, will set between 3.45 a.m. and 5 a.m. at the beginning of the month; the Moon passing close on the nights of the 20th-21st. By the end of the month will set between 1.45 a.m. and 3 a.m.

Saturn.—Too close in line with the Sun for observation at the beginning of the month, but at the end of the month may be seen low in the east during morning twilight, in the constellation of Virgo.



CENTAURUS (THE MAN-HORSE)

CENTAURUS.

As mentioned in last month's Journal, this constellation adjoins the constellation of the Southern Cross, and it is easily seen from the diagram how simple it would have been to include the Cross in the constellation of Centaurus—in fact, Centaurus seems incomplete without it. The Centaurus group is said to represent the brave and kindly centaur, Chiron, who succoured the young Jason and taught the arts of peace and war to many of the mythological heroes. Being situated near the Milky Way it contains many interèsting doubles and clusters, as well as several bright stars, the most brilliant stars in the constellation being the "pointers" to "the Cross." The star of the pointers farthest from "the Cross" is known to navigators as Rigel Kent, the Kent being an abbreviation for Kentauri, a variation of Centauri. This star is the third brightest in the heavens, and though it appears to the naked-eye as a single star, under magnification it appears as three separate stars all revolving round a common centre of gravity. One of the stars of this group, now called Proxima Centauri, is the closest known star to Earth, being 4.2 light-years away—a light-year is 5,878,000,000,000 miles.

Other interesting objects in this constellation are the beautiful globular cluster, Omega Centauri, which can be seen with the naked-eye as a star of about fourth magnitude but which with optical aid appears as a "heap of pearls"; the naked-eye doubles of Mu and Nu and Epsilon, and the telescopic cluster of about 200 stars—47 Centauri.

Like the Southern Cross, this constellation is an evening object from about March to September, though from Queensland it is below the horizon for only about 4 hours every day. On October 1st it reaches the Meridian or North-South line about one hour after noon, setting about 7 p.m. It will reach the Meridian about 2 hours earlier each month, so that by April 1st it will be on the North-South line about 1 hour after midnight.

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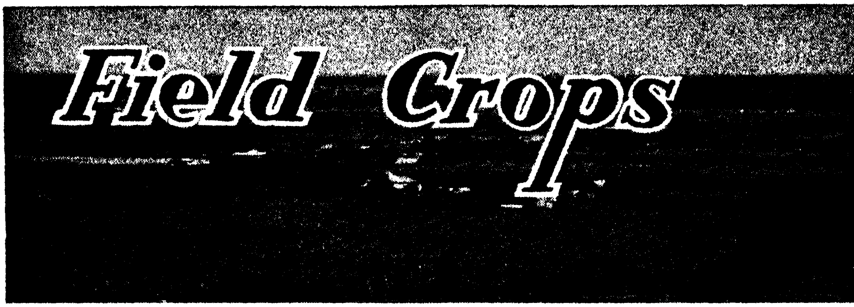

Queensland Certified Hybrid Maize.

Part 1. The Story in General.

W. W. BRYAN, formerly Plant Breeder, Queensland Agricultural High School and College, Lawes.

[Editorial Note.—A progress report on hybrid maize production in Queensland was published in this journal in October, 1949. The State certified hybrid maize programme has now reached a stage at which it is desirable to place on record a statement of the work that has been done and to detail the procedure that has been adopted for certified seed production. The subject will be dealt with in three parts.]

INTRODUCTION.

Late in 1925 the first hybrid maize breeding programme in Australia was begun at the Queensland Agricultural High School and College, situated at Lawes, in the Lockyer Valley. Queensland was the first State to realise the value of maize hybrids. It was known that the older breeding methods of various types of selection and of the crossing of varieties would no longer give marked improvement, and the hybrid maize programme was undertaken as it offered promise of progress. The intervening twenty-four years have produced results which have amply justified the faith of the early sponsors of the work, and the purpose of this series of articles is to tell the story of hybrid maize in Queensland.

The first plant breeder engaged in the programme was Mr. (now Professor) J. R. A. McMillan. On his resignation in 1929, the author was appointed in his place and was in charge of the work until August, 1950. It will be understood that a large breeding programme is a matter of team work, and it is desired to acknowledge the very great assistance that has been given in the general conduct of the work and in the final shaping of procedures by Messrs. C. C. F. Bourne, E. U. McCarthy and L. T. Petersen. Their experience and judgment have been most useful. Messrs. S. Marriott, A. J. Schindler and P. W. Grogan also gave valuable service when associated with the College plant breeding section.

TYPES OF MAIZE.

Maize types now in existence are either varieties or hybrids. The varieties are known as "open-pollinated," as their pollination is not controlled. Even in normal and reasonably even crops of standard varieties there is a loss of up to 15 per cent. in yield caused by sterile stalks, by stalks producing only nubbins, and, in general, by a large amount of variation among individual plants and ears throughout the

field. The usual method of maintaining these varieties at their standard of excellence (or even raising this standard slightly) is by selection. This consists of selecting plants in the field and later selecting ears from these plants in the barn. The male or pollen parents of the selected seed ears are unknown, and pollen from some inferior plants at least will have taken part in fertilisation. This will result in undesirable characters reappearing in later generations.

Hybrid maize results from controlled breeding in which the parents of each plant are known and are uniform. If good parents are used, a uniform crop of good hybrid plants is produced and the 15 per cent. loss found with open-pollinated varieties is eliminated. Production of hybrids is the only known method of obtaining substantial yield increases in maize.

PRODUCTION OF HYBRIDS.

To produce hybrid maize, the following steps are carried out. They are shown diagrammatically in Plate 145.

(*a*) An outstanding maize plant from a standard or introduced variety is chosen. The ear from this plant is then inbred by "selfing" (i.e., placing the pollen produced by a single maize plant on its own ear silks). This procedure is followed for six to eight generations, and is normally done by controlled hand pollination. During this time all plants showing bad characters are discarded and only those with the required good characters are carried on. The process is continued until the selected plants breed true and are uniform. The resultant strain of maize, after tests to prove its usefulness in crosses, is then classed as an "inbred-line." These inbreds are smaller than normal types and their yield is from 5 to 15 bushels per acre, so they are useless in themselves for grain production.

By selecting different plants of many varieties for the initial inbreeding, inbred lines of widely different types can be obtained. It is essential for success that a series of inbreds of differing type and characters should be available.

(*b*) Two contrasting inbreds (e.g., A and B) are then crossed to produce the "single-cross" AB. This single-cross is much more vigorous and has a much higher yield than the inbreds. In fact, it compares more than favourably with the original open-pollinated plants from which it was bred. However, owing to the breeding process, the seed from which this single-cross grew was borne on an inbred ear, and only a small amount of seed is available. Single-cross seed cannot therefore be produced economically on a commercial scale. There is, however, a way out of the difficulty. It is found that if two *different* single-crosses are crossed together, the resultant second-cross or double-cross hybrid is not inferior to either of its immediate parents; so the process is carried one step further. Two more inbreds, C and D, are combined to form another single-cross, CD.

This process of breeding the two single-crosses is carried out at the Agricultural College. It represents Stage 1 in Plate 145.

(*c*) The two single-crosses (AB and CD) are then crossed to form the "double-cross" ABCD (Stage 2 in Plate 145). This time the seed is borne on single-cross ears and large quantities of seed can be produced economically. The double-cross thus made is the final hybrid seed,

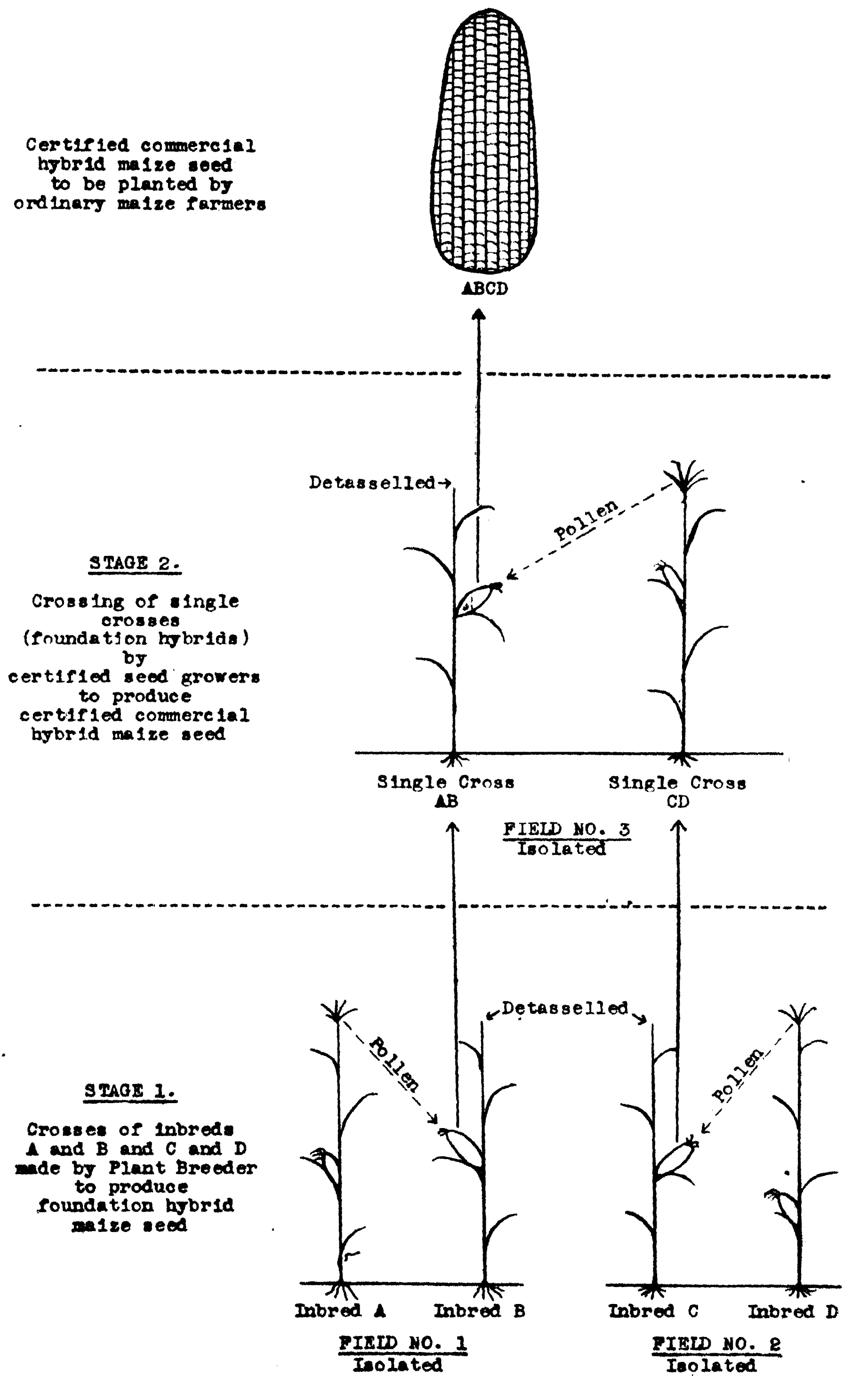

Plate 145.

Diagram Showing the Stages in the Production of Hybrid Maize Seed.

which, when planted, produces the hybrid crop. All modern hybrids are of this double-cross type. This cross is made under certification by the grower of hybrid seed maize who has obtained his parent (single-cross) seed from the Seed Certification Committee.

Seed should not be selected from a crop of hybrid maize. If seed is taken and planted, it will be found that yield will decrease by 12 per cent. to 25 per cent. each year. A hybrid is a "mule" in the sense that it does not reproduce its kind, but, unfortunately, it is a fertile mule which produces, as it were, only broken-winded donkeys. Fresh crossed hybrid seed must be planted each year. This means, also, that all stages of seed production—i.e., maintenance of inbred stocks, first crosses between inbreds, and the final cross between single-crosses—must be carried on continually if a steady and adequate supply of hybrid seed is to be made available.

PRODUCTION OF HYBRIDS ON A COMMERCIAL SCALE.

The whole success of the scheme for production of seed depends on maintaining crops which are isolated throughout the flowering period, so that no cross-fertilisation takes place other than that controlled by the grower. Therefore, isolation is the first necessity in growing a crop of hybrid seed. The rule for isolation is that no maize, other than the pollen parent, which is likely to shed pollen while receptive silks are still present on the ear parent plants, may be grown within 20 chains of the crossing plot.

With a large number of inbreds and breeding stocks to be maintained in any quantity, a large number of breeding plots and isolated crossing plots would be necessary. More crossing plots, also isolated, would be required to produce the hybrid seed. This is not practicable with the resources of only one breeding station. All that can be done at the Queensland Agricultural College is to maintain the inbreds and parent stock. It is therefore necessary for maize farmers to take part in the production of the hybrid seed.

This is done as follows:—

(*a*) The grower obtains parent (single-cross) seed from the Committee and plants it in an isolated block, according to a prearranged plan, in separate pollen and ear rows.

(*b*) When the crop flowers, he ensures that *no* pollen is shed by any of the plants in the ear rows. This is done by removing the tassels from the ear plants before they shed pollen, and usually this operation covers a period of two to three weeks, working the plot every day.

(*c*) When the crop is ready to harvest, the ear (detasselled) rows are picked and shelled; the resultant seed is the hybrid maize seed. The product of the pollen rows is useful only as grain for feeding purposes.

The whole procedure as outlined is covered by a seed certification scheme, and inspections are made of the seed before and during the growing and harvesting of the crop, so that the final product may be certified as hybrid maize seed. This will be explained further in Part 2 of this series.

COSTS OF SEED PRODUCTION.

As will be fully explained in a later section, two types of certified seed producers are recognised under the certification scheme. A commercial producer is a farmer who grows certified seed for sale as such, and a home producer is one who grows hybrid seed for his own use.

A commercial producer of certified hybrid maize seed will make a substantially higher profit than from growing a crop of maize for feed grain. For example, comparing gross returns on the basis of a 40-bushel crop, and assuming that a crossing plot will yield approximately 60 per cent. of seed and 40 per cent. of feed grain, we have the following:—

Ordinary Grower.	£	s.	d.	*Hybrid Seed Producer.*	£	s.	d.	£	s.	d.
40 bushels at 8s.	16	0	0	24 bushels at 60s.				72	0	0
				16 bushels at 8s.				6	8	0
				Gross return				78	8	0
				Less extra costs—						
				For parent seed	1	0	0			
				For working, etc.	10	10	0			
								11	10	0
				Gross profit				£66	18	0

Additional gross profit is thus £50 18s. per acre.

A home producer will be paying only 8s. 5d. per bushel instead of 60s. for his seed, as shown in the following statement, in which a 40-bushel crop is assumed:—

	£	s.	d.	
Initial cost of production (i.e. ground preparation, cultivation, etc.)	5	0	0	per acre.
Extra cost for hybrid crossing plot	11	10	0	„ „
Total cost	£16	10	0	
Less 16 bushels grain for feeding at 8s. ..	6	8	0	
	£10	2	0	

24 bushels of hybrid seed produced at a cost of £10 2s. 0d. = 8s. 5d. per bushel.

ADVANTAGES AND DISADVANTAGES OF HYBRID MAIZE.

Advantages.

Hybrid maize has a higher yield. The hybrids will not be released for commercial sale unless they outyield the best local varieties in an official test over three seasons by at least 15 per cent., except where, in the opinion of the Seed Certification Committee, a hybrid merits certification for a special purpose, as in the case of very early maturing varieties.

Field characters are sound. Characters such as uniformity, erect stalks, good root system, etc., are fully as important as yielding ability, and hybrids must combine these characters with the 15 per cent. yield increase. Any hybrid possessing a major weakness is discarded, regardless of its yield. Hybrids are definitely easier to harvest than present day varieties, partly because of these characters.

Disadvantages.

Seed costs are slightly more. However, this extra cost is covered by the 15 per cent. increase, as shown by the following example.

Take a planting rate of 8 lb. per acre (i.e. 7 acres per bushel).

	s.	d.			
Cost of certified hybrid seed	60	0	per bushel.		
Cost of open-pollinated maize seed ..	17	6	„	„	
Additional cost of certified hybrid seed	42	6	„	„	(i.e., 6s. 1d. per acre)

Let us assume that the best open-pollinated variety in the district will yield, on the average, 40 bushels per acre. A 15 per cent. increase will be six bushels.

	£	s.	d.	
Value at 8s. per bushel	2	8	0	per acre
Less extra seed costs	0	6	1	„ „
Gross extra profit	2	1	11	„ „

Seed cannot be taken for further planting from a crop of hybrid maize without serious loss of yield. This is a definite disadvantage, but the 15 per cent. increase in yield more than compensates for this.

QUEENSLAND DATA.

To date, 1,040 different maize types, of which approximately 700 have been standard varieties, have been introduced into the Queensland breeding programme. They have come from all parts of the world, but chiefly from the Americas and Australia. It is significant that the vast majority of the more useful inbreds produced at Lawes have come from varieties which have been established in Australia for many years. The value of local material as parent stock is undoubtedly great.

A vigorous policy of inbreeding was followed through the thirties, several hundred inbred strains being produced. Only a small proportion of these survived tests for combining ability, and the State now possesses 93 well tested inbred lines, four of which are new within the last year Of the remaining 89 inbreds, 56 have been produced at Lawes, while 33 have been obtained from other sources. Queensland inbreds have also been distributed to other hybrid maize breeders and are now playing an important part in the New South Wales work at Grafton.

With 89 inbreds, 3,916 single-crosses can be made, and from these 2,441,626 different double-crosses can be made. To date, 819 single-crosses have been made, of which 115 are in use as parents, and 1,012 double-crosses produced, the first 58 of them in 1933. Of these, 704 have been discarded as of insufficient merit; 24 have earned the right to be certified, and 284 are still undergoing performance tests. It is obvious that vast scope exists for producing more and more hybrids, and there can be no doubt that future hybrids will set new standards of excellence.

The yields of hybrids certified in 1949 were given in the October, 1949, number of the *Queensland Agricultural Journal.* Initial tests are carried out at the Queensland Agricultural College, Lawes, and the more promising hybrids are then tested in official trials on private farms throughout the maize growing areas of south-eastern Queensland. The

period 1935 to 1950 was one of great activity in testing performance. Over that period 151 official yield trials were planted and 121 of these were successfully harvested. Distribution of trials planted has been as follows (see also Plate 146).

Coastal Moreton.

Imbil	7
Kilcoy	2
Beaudesert	1
Rathdowney area	18
	28

South Burnett.

Murgon	10
Wooroolin	10
Coolabunia	9
Kumbia	8
	37

West Moreton.

Boonah	9
Harrisville area	11
Laidley	3
Mulgowie	2
Upper Tent Hill	2
Lockrose	5
Brightview	8
Morton Vale	5
Toogoolawah	1
	46

Darling Downs.

Warwick	8
Glengallan	2
Clifton	3
Westbrook	13
Boodua	8
Cabarlah	1
Kulpi	1
	36

Callide.

Biloela	4

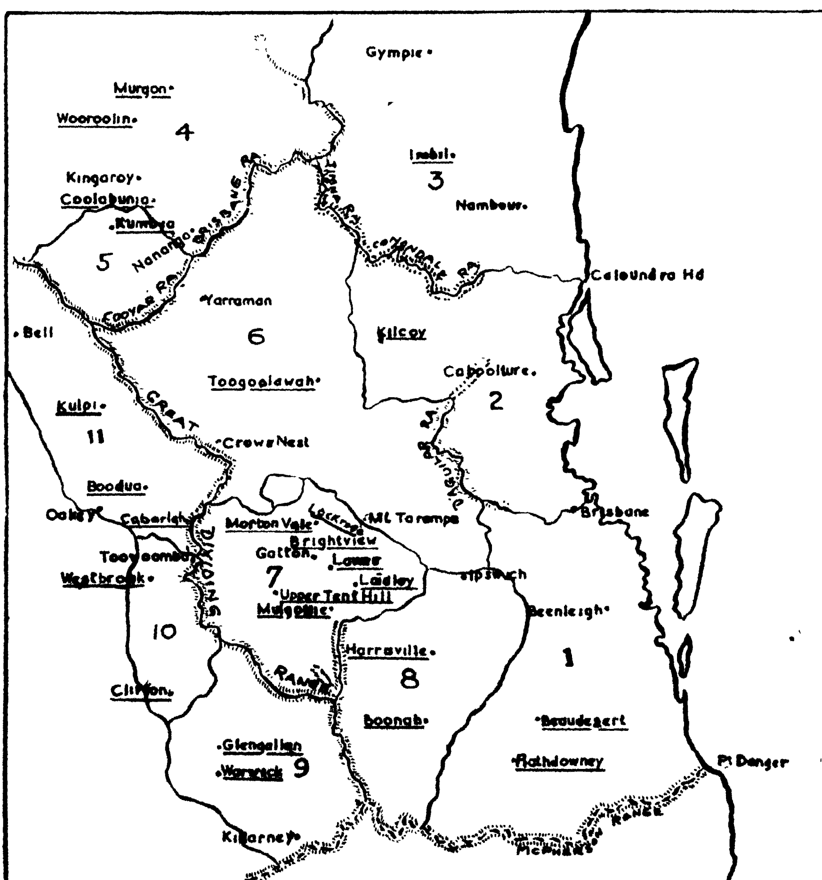

Plate 146.

Sketch Map of Hybrid Maize Certified Seed Districts.—Official trial sites are underlined.

As a result of these tests there is a definite assurance that hybrids recommended for certain areas have been carefully studied in those areas. Hybrids have limited ranges of adaptation, as do open-pollinated varieties. Some hybrids do well in some areas and not in others. The Queensland certified hybrids are useless on the Atherton Tableland, while U.S.A. hybrids from the Corn Belt have poor husk cover and have no place in Queensland except on the southern Darling Downs. This is exemplified by the performance of DS28 from Armidale, which, although it is quite successful south and east of Clifton, is elsewhere in Queensland quite unsuited and has averaged nearly 19 per cent. less in yield than good standard varieties in the six trials so far carried out with it. A grower must consider each hybrid individually and should grow only such hybrids as are proven for his district.

SOME QUEENSLAND HYBRIDS DESCRIBED.

Q23.—This hybrid, which matures in 5½ to 6 months, has an unusually dark colour, suckers more than the average, and is fairly leafy. The average height is 9 ft. to 10 ft. It has good root and stalk strength, the only weakness being that on rich red scrub soil some stalk breaking occurs at maturity. Husk cover is slightly short and not particularly tight, but ears turn down at maturity. The ears, which are carried rather high on a slightly long shank, are of good weight, 8 inches long and yellow to reddish yellow in colour. The grain is not thick and sometimes a little dull, has a moderate crease, and is inclined to be starchy. The cores are of moderate thickness, and grain depth is good. The highest yield recorded for this hybrid has been 113 bushels per acre, and it has yielded an average of 54.0 bushels per acre in 37 trials, against 45.8 bushels per acre for the best standard varieties in the same trials. Q23 is certified for the Coastal Moreton, West Moreton and South Burnett districts.

Q431.—This hybrid is of 5½ to 6 months maturity, and has good leaf colour and a moderate amount of suckering, but the plant is not particularly leafy and is only a fair green fodder type. The average stalk height is 9 feet, with taller growth on the coast. Normally this hybrid remains fairly erect, but on rich red scrub soils the stalks tend to break at maturity, although on forest red and black soils this defect is not apparent. Leaves are slightly susceptible to rust. Husk cover is adequate, the shanks slightly long, and 60 to 70 per cent. of the ears turn down at maturity. Ears are borne a little high and are 8 to 8½ inches long, moderately thick with a slight taper, and are of good weight. The grain is yellow in colour, with some paler caps, and has a bright lustre and a moderate crease. The number of rows is approximately 16, and the rows are slightly open. Grain quality, core thickness, and grain depth are about average. The ear type is generally attractive. The highest yield recorded for this hybrid in official trials has been 111 bushels per acre, and the average yield over 27 trials has been 53·6 bushels per acre against 44·9 for standard varieties. Q431 is certified for the South Burnett and West Moreton districts.

Q629.—This is a hybrid of 5½ to 6 months maturity, of dark leaf colour, not particularly leafy, only slight suckering, and a moderate green fodder type. Height is about 9 feet. Plants are fairly erect, and there is a slight tendency to lodge at maturity. Husk is somewhat short, but the ears, which are carried a little high, hang down at maturity. Ears are 8 inches long, more or less cylindrical, with slightly

open rows which are not quite regular; the colour is yellow and the grain slightly starchy but with only a moderate crease. The ears are not of show type but are attractive. The grain is slightly susceptible to weevil attack. The highest yield recorded for this hybrid has been 117 bushels per acre and the average yield over 37 trials has been 53·5 bushels per acre compared with 45·9 for the best standard variety. Q629 is certified for Coastal Moreton, West Moreton, and South Burnett districts.

Q692.—This hybrid matures in 6 months. It has fair to good leaf colour and a moderate amount of suckering. The average height is 9 feet and the plants are erect and fairly leafy. The husk cover is a little short. Ears hang down well at maturity. Ear height is satisfactory, the ears being 8 inches long, moderately thick, and tending to taper. Grain colour is yellow with a slight reddish tinge. The crease is average, rows somewhat open, and the grain very slightly starchy but bold and of fair depth. The highest yield recorded for this hybrid had been 98 bushels per acre and the average over 28 trials has been 53·4 bushels per acre against 46·3 for the best standard variety. Q692 is certified at present only for the South Burnett but may be given certification in the West Moreton.

Q716.—This hybrid takes 5 to 5½ months to mature, has vigorous plant growth, stands up well to adverse conditions, and is not susceptible to lodging. Plant height averages about 8 feet, and it makes a fair fodder type. The husk cover is somewhat short and loose, but the ears hang down well at maturity. The heavy ears are of deep orange colour and are tapering, of average diameter, approximately 8½ inches long, and carry 22 rows of fairly tightly packed grain. The grain is of good lustre, fairly hard, of medium depth, and inclined to be slightly peg-tooth shaped with a medium dent. The highest yield recorded for this hybrid has been 99·5 bushels per acre and the average over 44 trials has been 48·8 bushels per acre compared with 42·2 for standard varieties. Q716 is certified for the South Burnett, West Moreton, and Southern Darling Downs.

Q717.—This hybrid matures in 5 to 5½ months, has good plant colour, and suckers a fair amount, but is not very leafy. Plants are 8 feet tall and show a slight tendency to lodge. The husk is somewhat short and a little loose, but the ears hang down well at maturity, being carried on moderately long shanks. Ear height is good, the ears are 8 inches long, heavy, of moderate thickness with a slight taper. The grain is yellow and of good lustre, has a moderate crease, and is inclined to be a little shallow. Grain rows are a trifle irregular and open. The highest yield recorded for this hybrid has been 104 bushels per acre, and it has averaged 51·2 bushels per acre against 45·1 bushels per acre for standard varieties in 33 trials. As yet Q717 is certified only for the West Moreton district.

Q739.—This hybrid matures in 4½ to 5 months and has done well in the cooler upland regions of south-eastern Queensland. It has sturdy stalks, good plant growth, is hardy, and has a good root system. The husk is good and the ears hang down at maturity. The ears are heavy, fairly symmetrical, 8 inches long, and with slightly open rows; the grain is yellow, bright, of good medium quality, and only slightly shallow. The shanks break easily and cleanly at harvest. The highest

yield recorded for this hybrid has been 87·6 bushels per acre and the average over 32 trials has been 47·9 bushels per acre against 42·8 for standard varieties. Q739 is certified for the South Burnett (except the southern end), West Moreton, and Darling Downs.

It is of interest to summarise (Table 1) the yield records of eight of the leading certified hybrids, remembering that these are full results which include trials in regions for which some of the hybrids are neither suited nor recommended. The first four of these hybrids are long-season or late-maturing types; the second group matures two to four weeks earlier.

TABLE 1.

AVERAGE YIELDS OF HYBRIDS IN OFFICIAL TRIALS.

Hybrid.	Average Yield.	Yield of Best Standard Varieties.	Number of Trials.	Percentage Increase.
	Bush per acre.	Bush. per acre.		
Q23	54·0	45·8	37	17·8
Q431	53·6	44·9	27	19·4
Q629	53·5	45·9	37	16·5
Q692	53·4	46·3	28	15·3
Av. of late maturing hybrids	53·6	45·75	129	17·2
Q440	47·3	40·7	44	16·2
Q716	48·8	42·2	44	15·9
Q717	51·2	45·1	33	13·6
Q739	47·9	42·8	32	11·9
Av. of earlier hybrids	48·7	42·5	153	14·6
Av. of all eight hybrids	51·0	44·0	282	15·9

The table shows that a gain of at least two bags of grain per acre can be expected in Queensland from the use of recommended hybrids. Hybrids are not super types, but they do represent a definite advance on older varieties. In Illinois and Iowa, in the U.S.A. Corn Belt, with an aggregate area of some 14,000,000 acres of maize, hybrids now comprise at least 99 per cent. of the crop grown, the increase in yield being of the order of 20 per cent. Queensland is not yet in this happy state, but the position is improving. New and better hybrids are in production and we can look forward to the future with confidence.

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Mechanical Harvesting of Cotton in Queensland.

R. W. PETERS, Plant Breeder.

SHORTAGE of rural labour in Queensland has been a serious problem in recent years to primary producers in general and cotton growers in particular, and the serious decline in cotton production can be attributed in large measure to this shortage. The widespread use of mechanical equipment during the war years impressed landowners with the possibilities of mechanisation in overcoming the general shortage of rural labour. This is not confined to Queensland or Australia. For instance, the United States of America—the largest cotton producing country of the world—is experiencing the same problem in its cotton growing industry. To-day great changes are taking place in the methods of cotton production, and it is envisaged that in the near future the principal cotton growing countries of the world will adopt mechanised methods in all phases of cotton production, the most important being the widespread use of mechanical harvesting machines, thousands of which are being produced annually in American factories.

HISTORICAL.

Attempts to construct a mechanical cotton harvester date back to 1850, but it was not until 1937 that Rust Brothers, of Memphis, U.S.A., produced the first commercial mechanical harvester. This was followed a few years later by the McCormick-Deering picker.

The time taken to evolve a satisfactory machine gives some indication of the difficulties of the problem that inventors and engineers were required to solve, and the setbacks and disappointments which necessarily operated before success was achieved.

During this period of experimentation numerous types of machines were devised, but they all fell into five general classes, as follows:—

(1) The *picker* type of cotton harvester was designed to pick cotton from the open bolls by means of spindles, fingers or prongs at any time during the harvesting season without damaging unopened bolls and branches. This is the type now in commercial use in Queensland.

(2) The *thresher* type takes the entire plant into the machine, where the cotton is separated from the vegetative matter.

(3) The *pneumatic* type removes the cotton from the bolls either by suction or by air blasts.

(4) The *electrical* type depends upon attracting the cotton fibres to a statically charged belt or finger to remove the cotton from the plant.

(5) The *stripper* type of harvester removes the cotton from the plant by combing the bush with, or drawing it between, stationary slots or revolving rolls. This type of machine has possibilities under the climatic conditions of the Darling Downs and Maranoa, where large acreages of cotton could be planted. These districts usually receive early frosts and the stripper could harvest the entire crop in one operation following killing frosts.

MECHANICS OF THE PICKER TYPE.

There are four mechanical harvesters of the picker type operating at present in Queensland—two Rust machines and two McCormick-Deering machines. As both are essentially the same in principle, a description of the salient features of the McCormick-Deering machine adequately outlines the operations involved in the picker type.

The McCormick-Deering picker is designated as the M-11-H. It is a high drum type, which operates successfully in cotton growing up to five feet high, and is a one-man, one-row machine.

The picker is mounted on the rear of a modified Farmall M. tractor which operates in the reverse direction; that is, the drive wheels become the front wheels. The tractor provides the power to operate the picker mechanism and propels it through the field.

The picker is provided with two vertical parallel revolving drums between which the cotton plants pass as the machine moves forward along the rows. Each drum is equipped with cam-actuated picker bars on which are mounted rotating spindles having numerous barbs which catch the cotton. The rotative speed of the picker drums is synchronised with the travelling speed of the tractor so that the projecting rotating spindles enter and withdraw from the plants without disturbing the unopened bolls or otherwise injuring the plants.

As the rotating spindles penetrate the plants and contact the open bolls, the barbs catch the cotton and extract it. As the cam-actuated picker bars carry these cotton-laden spindles around they are withdrawn from the plant and the cotton is removed by rubber doffers which rotate in close proximity to the spindles. Before the spindles contact

Plate 147.

A McCormick-Deering Cotton Harvester, Showing Cotton Plant Entering the Spindles.

the open bolls they pass under moistened rubber pads. The moisture assists in the doffing of the cotton. A water tank and metering system which supplies water to the rubber pads in uniform amounts is controlled by the operator, as moisture requirements vary under changing conditions.

Plate 148.
A McCormick-Deering Harvester Operating in a Crop Which Yielded 746 lb. Seed Cotton Per Acre.

Plate 149.
A Rust Cotton Picker Operating in the Kingaroy District.

Plate 150.
Rear View of the Rust Cotton Harvester.

After removal from the spindles the cotton is conveyed by suction to a separating chamber where considerable trash is removed. It is then blown up into the storage basket by air pressure produced by fan equipment. As the cotton enters the basket it passes along a grating which assists in removing loose trash and dirt held in the fibres. When the basket, which holds approximately half a bale of seed cotton, is full the contents are dumped into a wagon or truck by a mechanism powered by the Farmall hydraulic lift.

The driver is the only attendant required to operate the machine. He sits above the drum box and has a full view of the cotton row being picked. A diagram illustrating how the cotton picker works is shown in Plate 151 by courtesy of the International Harvester Company.

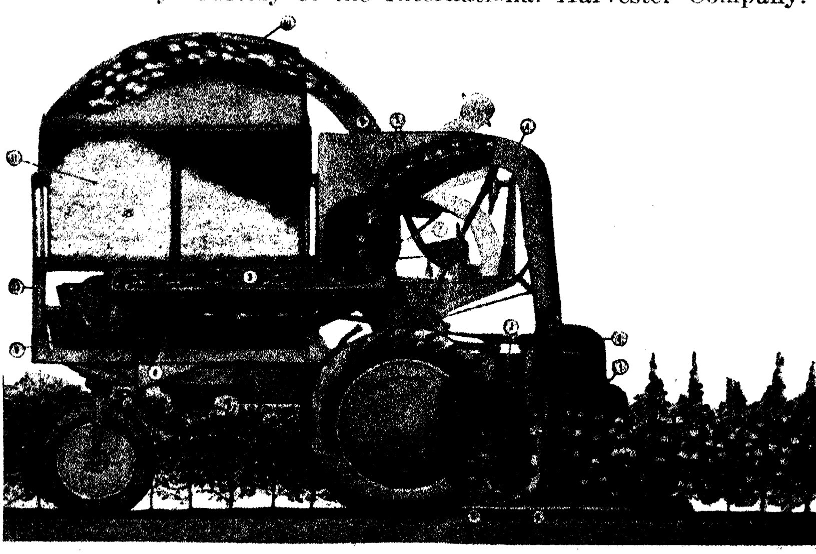


Plate 151.
Diagram Showing How the McCormick-Deering Cotton Picker Works.—
A description of the operations is given on the opposite page.

RESULTS WITH MECHANICAL HARVESTERS IN QUEENSLAND.

Summarising the results obtained over the years that the Rust and McCormick-Deering mechanical harvesters have operated in Queensland, it has been demonstrated that provided a field of cotton has received proper cultural care, is free of sticks, stones and rubbish, and the plants have developed normally, the mechanical harvester will pick cotton satisfactorily and efficiently at less than half the cost of hand picking and each machine will do the work of at least twenty pickers.

Cotton should not be allowed to remain open too long in the field, as exposure to the weather results in loss of grade; the cotton becomes dull by the action of rain or with the continued nightly wetting by dews, and the subsequent drying by the sun. This change of colour to a dull chalky white destroys the lustre of the fibres and no amount of cleaning prior to ginning will improve the quality of the sample. In addition, cotton left exposed soon loses weight and strength and is liable to collect more leaf trash. Cotton should therefore be harvested when there is sufficient open to warrant the use of the picker—a yield of approximately 500 pounds of seed cotton per acre or more is satisfactory. The amount of cotton mechanically picked in a treated field varies from 85 to 95 per cent. of the open crop. Tests carried out in the field during harvesting operations have shown that most of the cotton left on the plants consists of weak immature fibre in partially diseased locks which if picked would lower the grade of the cotton harvested and reduce its value.

Table 1 gives some indication of the efficiency of the mechanical harvester when working in fields suitable for its operation. Under less favourable conditions the percentage of open cotton picked has not been as satisfactory as the figures quoted in this table.

DESCRIPTION OF PLATE 151.

In the revolving picker drums (1 and 2) are the rotating barbed spindles which pick the cotton from each side of the plant.

Rubber doffers (3) remove the cotton from the spindles. The cotton drops down to the air conveyor inlet (4).

Moisture applicators (not shown) moisten the spindles, before they enter the plant, to aid in picking and doffing the cotton.

The vacuum conveyor system (4) draws the cotton from the air conveyor inlet to the grates (5).

At the grates part of the dirt and trash is removed with the air drawn into the vacuum fan (6).

The cotton drops from the grates (5) down to the revolving vacuum seal rotor (7) which transfers the cotton to a lower compartment. Here the cotton is picked up by the air blast conveyor system (9), powered by the air blast fan (8).

Cotton is blown against grates (10) at the roof of the basket (11). Additional dirt and trash are expelled through the grates and the cotton drops to the bottom of the basket.

Two hydraulic cylinders (12), powered by the Farmall Lift-all pump, raise the basket for dumping the cotton into a wagon or truck.

TABLE 1.

SOME DATA ON MECHANICAL COTTON HARVESTING IN QUEENSLAND COTTON FIELDS.

District.	Variety.	Acreage.	Pick.	Average Yield Seed Cotton per acre.	Amount Seed Cotton Picked per hour.	*Grade Seed Cotton.	Grade Lint.	Percentage of Open Cotton Picked compared to clean hand picking.
Home Hill	Triumph ..	5·75	..	lb. 746	lb. 558	All S.M. 3	S.M.3	90
Biloela	Miller and New Mexico Acala	9	..	628	401	All S.L.M. 2	S.L.M. 2	86
Theodore	Triumph† ..	19	1st	650	351	lb. 4,925 .. S.M.L.S. 3 7,380 .. M.L.S. 3	M.L.S. 3 S.L.M. 3	90
			2nd	324	252	6,156 .. S.L.M. 2	S.L.M. 2	
Theodore	Miller† . ..	23	1st	1,046	559	15,918 .. S.M. 3 8,134 .. M. 3	S.M. 3	
			2nd	163	136	3,748 .. M. 3	S.L.M. 3 M. 3	95
Theodore	Miller†	9	1st	1,372	823	12,346 .. S.M. 3	S.M. 3	95
			2nd	211	190	1,907 .. S.L.M. 3	S.L.M. 2	
Theodore	New Mexico Acala†	6	1st	463	253	2,778 .. M. 3	M.L.S. 3 S.M.L.S. 3	85
			2nd	104	104	624 .. S.L.M. 3	S.L.M. 2	
Theodore	Miller	50	.	315	235	7,527 .. M. 3 8,217 .. S.L.M. 3	S.L.M. 3 S.L.M. 2	90

* Cotton grades are based on World Universal Standards for American Upland Cotton and are as follows in descending order of quality :—M.F.—Middling fair ; S.G.M.—Strict good middling ; G.M.—Good middling ; S.M.—Strict middling ; M.—Middling ; S.L.M.—Strict low middling ; L.M.—Low middling ; S.G.O.—Strict good ordinary ; G.O.—Good ordinary ; Every grade may be modified by light spot (l.s.) or yellow spot (y.s.), except that no spot is allowed in M.F., no yellow spot in S.G.M., and no spot modifications are used with S.G.O. or G.O.

† Irrigated crops.

The McCormick-Deering cotton harvester is modified to operate in the reverse direction and is geared for two picking speeds. The first gives a speed of two miles per hour and is used for heavy crops and particularly first pickings where the yield of seed cotton exceeds 1,000 pounds per acre. The second speed is 2¾ miles per hour and is used for lighter crops and second picks.

Under Queensland conditions the picker averages 500 pounds of seed cotton per hour, but the rate varies according to the amount of seed cotton open. Since the speed of the machine is constant, and the picking percentage is also somewhat constant, the amount of cotton picked in a given time will be proportional to the yield of open cotton on the plants. Therefore the machine can be operated much more efficiently in high yielding crops.

TREATMENT OF MACHINE HARVESTED COTTON.

Machine picked cotton is usually graded lower than comparable hand picked cotton owing to its higher content of leaf and other foreign matter, and to improve the grade certain cleaning processes are necessary. In the United States of America, where a large proportion of the cotton crop is now mechanically harvested, considerable research

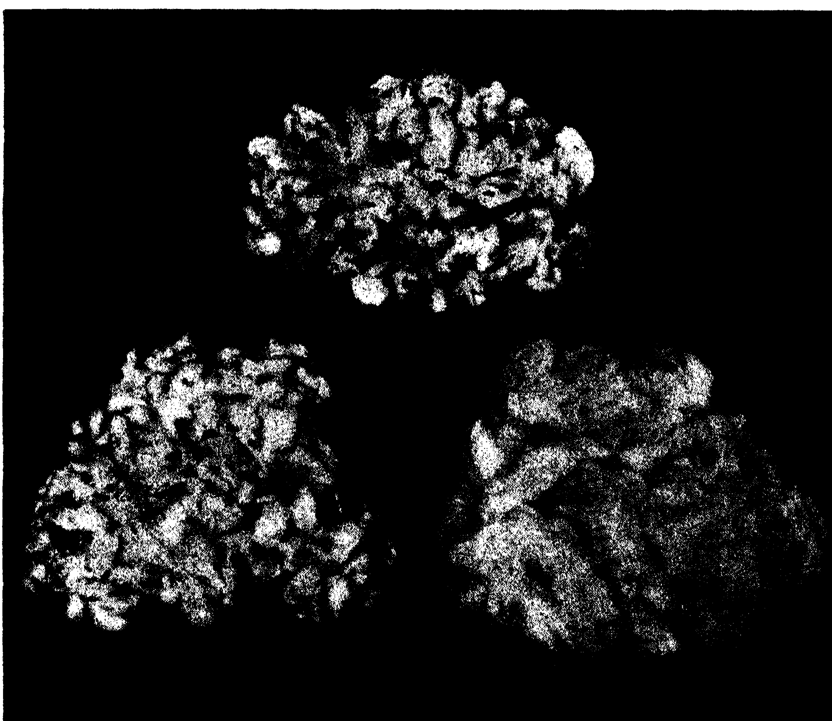


Plate 152.

Machine-picked Cotton. Top, sample showing trash, mostly dead leaf, in sample as picked. Bottom Left, the same sample after passing through airline and incline cleaners. Bottom Right, lint sample from the seed cotton at left after being ginned.

is being carried out for the purpose of raising the grade of this type of cotton, and certain machines are being developed. Until such time as the amount of machine picked cotton in Queensland warrants the purchase and installation of these specialised cleaning machines, considerable improvement can and is being made by the use of the existing airline and incline cleaners in the local ginneries. By these methods leafy samples of cotton can be improved by nearly three-quarters of a grade, which increases the value of the lint to approximately that of handpicked cotton.

CULTURAL AND PLANT BREEDING CHANGES REQUIRED FOR MECHANICAL HARVESTING.

The introduction of the mechanical cotton harvester into Queensland has necessitated some important changes in the cultural methods of production and breeding operations.

Cultural.

The wheel spacing of the picking machine is 38-42 inches, which necessitates a reduction in the normal Queensland row planting distance from 4-4½ feet to 3½-4 feet according to soil type, plant variety and locality. Some difficulty may be experienced in this respect on the more fertile alluvials where rank growth is likely to occur in wet seasons on old cultivations. However, the use of grassland rotations should allow of satisfactory results being obtained with the closer row spacing.

Rank growth is unsuitable for machine harvesting owing to the development of vegetative branches, too many of which prevent the spindles engaging the open bolls of seed cotton as they pass through the plant. Where heavy plant growth develops, it is sometimes necessary to repick the rows, working in the opposite direction. Some control in suppressing this vegetative tendency may be obtained by spacing the plants more closely. Good results have been obtained by this method in the United States of America, but the results from spacing tests carried out at Biloela Regional Experiment Station in Queensland have indicated that spacing too closely tends to reduce both yield and quality of the cotton produced. In the plant spacing operation it is suggested that thinning should be delayed slightly longer than previously recommended for cotton planted for hand harvesting. By leaving seedlings closely spaced until they attain the height of 8-10 inches, the development of basal vegetative growth tends to be checked, thus inducing the crop to form higher above ground level, and, as the picker fails to gather bolls formed close to ground level, loss of crop in harvesting is consequently reduced.

For the successful operation of the mechanical picker close attention must be given to cultural practices so that at harvesting time the field is free of weeds, grasses, sticks and rubbish. The last two obstacles can be instrumental in causing long delays, as well as possible serious damage to the machine; the capital involved in the purchase of these machines compels care in their operation in order to keep running costs at a minimum.

Plant Breeding.

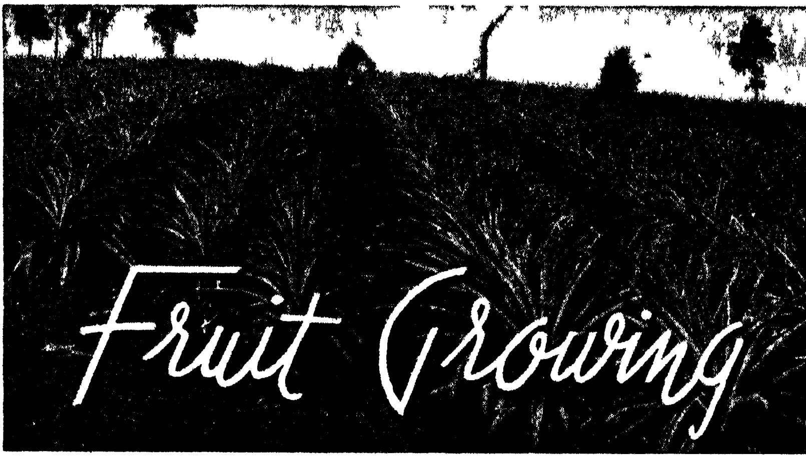
The ideal type of plant for mechanical harvesting is one not exceeding five feet in height, having an open habit of growth, with the bolls arranged symmetrically over the plant, and with a minimum of vegetative growth, particularly at the base of the plant. While

specialised methods of cultivation can do much towards the production of this type of plant, more can be done by careful breeding. Already progress has been made in improving the varieties being grown commercially and in testing new varieties that have recently been introduced for their potential suitability for machine harvesting, in relation to both plant type and fibre characters.

CONCLUSION.

In cotton growing in Queensland, land preparation, planting, crop cultivation and insecticidal applications can be handled very efficiently by ordinary farm machinery, but most seed cotton is still harvested by hand, necessitating a concentration of labour at picking time. On present indications, it seems clear that the solution of the harvesting problem is vital to the existence and expansion of the industry in this State.

The modern cotton harvester offers very bright hopes that the problem of shortage of hand labour can be overcome. For most efficient use and low picking costs, the co-operation of cotton growers is essential. Fields should be well cultivated and free of excessive weed growth, sticks, stones and similar rubbish which is liable to cause a breakdown of the harvester. It is also necessary that the cotton should be planted with a row interspace of 3½ to 4 feet in order to obtain the best results from the harvesting machine.



Horticultural Districts of Queensland.

5. North Coast.

P MITCHELL, Senior Adviser in Horticulture

THE North Coast horticultural district (Plate 154) is a coastal strip approximately 80 miles long by 15 to 25 miles wide, extending from the Caboolture River on the south to Gunalda on the north, and bounded on the west by the D'Aguilar and Blackall Ranges It embraces the shires of Caboolture, Landsborough, Maroochy, Noosa and Widgee, the principal towns in each being respectively Caboolture, Landsborough, Nambour (Plate 153), Pomona and Gympie

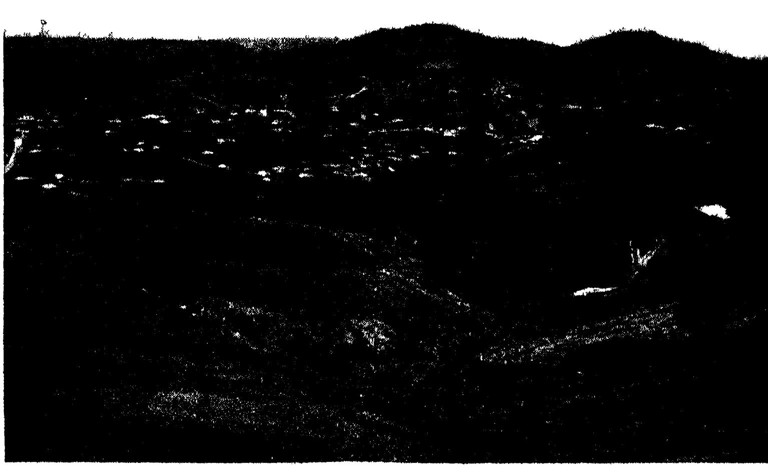


Plate 153.

View of Nambour, the chief town in the Maroochy Shire.

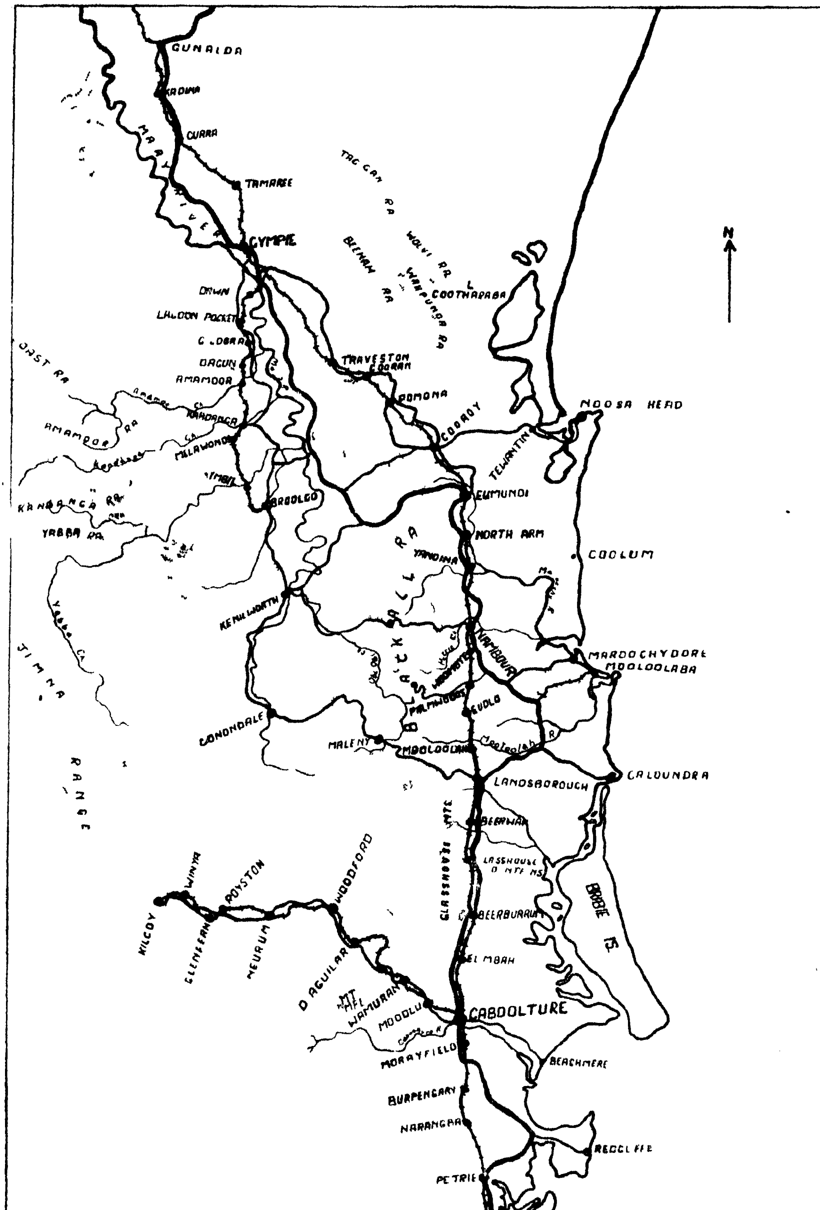


Plate 154.

Sketch Map of the North Coast District.

The district has been aptly termed the "garden of the State," since practically all sub-tropical crops flourish in it and contribute to its prosperity. The major primary industries are timber, dairying, cane growing and fruit production, the more important horticultural crops being pineapple, citrus, banana, papaw, avocado, nuts, strawberry, passion fruit, ginger, and beans and other vegetables. Associated

with these primary industries are numerous sawmills, butter factories at Caboolture, Maleny, Eumundi, Cooroy, Pomona and Gympie, a sugar mill at Nambour, and a ginger processing plant at Buderim. Large canneries catering for the fruit industry generally and the pineapple crop in particular are located in the metropolitan area.

Historical Development.

The earliest records of the district date back to 1865, when Buderim Mountain was first located as a source of timber, particularly cedar. However, owing to transport difficulties, timber was first cut in quantity on what is now known as Petrie Creek, a tributary of the Maroochy River. Buderim Mountain was one of the earliest settled areas on the North Coast, transport from Brisbane being originally by sea through Mooloolaba and Maroochydore. Transport by road was extremely difficult, though not impossible, for much overland traffic passed between Brisbane and Gympie during the gold rush of 1867. Buderim was settled about this time by timber-getters. Shortly afterwards sugar cane was introduced and at one time two mills were operating, but the industry declined when Kanaka labour, which was used in field work, was withdrawn from the area.

The fruit industry came into prominence after the decline of sugar. Bananas, mostly of the Cavendish and to a lesser extent Lady Finger varieties, were introduced, and this crop developed on a considerable scale, the fruit being carried by sea to Brisbane and selling at approximately 12s. per 100 dozen. The virgin country produced magnificient fruit, but thousands of bunches were sometimes dumped when rough weather prevented boats crossing the river bars and reaching the wharves. Citrus was introduced about 1890 and records reveal an annual production of up to 2,000 cases of excellent fruit from one orchard ten years later. Coffee plantations were established at the same time and a processing factory was erected at Buderim to treat the beans. This factory has since ceased to operate. A well known pioneer of the district won the diploma and gold medal for coffee at the Greater Britain Exhibition in 1899 against competition from exhibitors throughout the world.

March 1, 1890, was a red letter day for the North Coast, as a railway joining Landsborough to Brisbane was then opened and provided an alternative outlet for primary produce. From this time onwards, the fruit industry spread to districts opened up by the railway and much of the new country, such as the Blackall Range, was pioneered by the early settlers from Buderim. Pineapple growing commenced in the Woombye district at the close of the century and the industry has since spread through the whole of the North Coast district.

Facilities.

The North Coast district is well served by a fast train service to Brisbane, and good all-weather arterial roads linking the more important country towns with the capital city. As a result, there is an extensive tourist traffic to mountain resorts at Montville and Buderim and also to the beaches at Noosa, Coolum, Maroochydore, Mooloolaba and Caloundra. The district is supplied with excellent educational facilities.

The importance of the timber industry in the district is reflected by large-scale reafforestation projects at Glasshouse Mountains, Beerwah and the Mary Valley near Gympie. Horticultural crops on the North Coast are serviced by research and advisory officers of the Department

of Agriculture and Stock at Nambour and some other North Coast towns. The Maroochy Horticultural Experiment Station at Perwillowen, three miles from Nambour, was established a few years ago to provide facilities for plant breeding and selection work in pineapples, but problems in other horticultural crops are also being investigated at the station.

Climate.

The climate is mild, sub-tropical, with temperatures ranging from a mean minimum of about 42°F. in winter to a mean maximum of about 88°F. in summer. Temperatures vary according to proximity to the sea coast and altitude, and frosts occur in many parts of the district during June, July and August. The annual rainfall ranges from 45 inches at Gympie to 64 inches at Nambour. It is distributed throughout the whole year, with the heaviest rainfall during the period from January to March; light winter rains can be expected but the spring rainfall is variable and usually low. Table 1 shows the mean monthly rainfalls for Nambour, Caboolture and Gympie and the mean monthly temperatures for Gympie.

TABLE 1.

Climatic Data for North Coast Towns.

Temperature (Gympie).

——	January.	February.	March.	April.	May.	June.	July.
Mean Max. Temp. °F.	88·5	86·9	85·1	82·1	76·9	72·0	71·6
Mean Min. Temp. °F.	66·6	66·5	63·8	57·9	49·9	46·3	42·9

——	August.	September.	October.	November.	December.	Year.
Mean Max. Temp. °F. ..	74·1	78·9	83·7	86·7	88·5	81·2
Mean Min. Temp. °F. ..	44·2	50·2	56·5	61·3	64·9	55·9

Mean Monthly Rainfall (Points).

——	January.	February.	March.	April.	May.	June.	July.
Caboolture ..	796	782	783	448	327	274	237
Nambour	937	957	941	613	509	369	267
Gympie	657	658	613	343	291	260	207

——	August.	September.	October.	November.	December.	Yearly Total.
Caboolture	162	176	273	351	548	5,189
Nambour	188	226	323	421	665	6,416
Gympie	165	202	273	333	540	4,542

Soils.

As might be expected in a coastal area with high ranges running parallel to and relatively near the coast, the district includes a large variety of soil types. The alluvial flats along the major rivers and creeks are mostly used for the production of sugar cane. Horticultural industries are, however, developed on most other soil types. Perhaps the most important of these are the dark-brown to red-brown soils and the grey-brown soils of the Nambour-Woombye-Palmwoods district.

These are used mainly for pineapple production. They are generally low in organic matter and the major plant nutrients nitrogen and phosphoric acid. Provided they are reasonably well drained and adequately fertilized, these soils are highly productive. In the Beerburrum-Glasshouse Mountains-Beerwah areas, the soils used for horticultural crops are usually sands and sandy loams with a reddish brown subsoil. Many areas characterised by soils of this kind are subject to waterlogging and growers must, therefore, give very careful attention to land drainage, particularly in pineapple areas.

Basaltic red loams are represented by the soils of the Blackall Range and the Maleny and Buderim plateaux. Where these have been intensively farmed for long periods, the effects of soil erosion and leaching are apparent. Although these soils were originally very fertile, they are now low in essential plant foods and organic matter.

The Mary Valley soils are very variable and horticultural production in this district is mainly confined to relatively steep slopes, pineapples and beans being the major crops. Red loams and clay loams developed on jaspar are well drained but may be high in manganese which is responsible for induced iron deficiencies in some crops. These and similar soils in the district normally have a high pH value.

The horticultural importance of the North Coast district is obviously due less to the inherent fertility of its soils than to the growers' ability to use them for the economic production of the perishable commodities required for metropolitan and southern markets. A high standard of farming efficiency is demanded of growers in the area.

Plate 155.
Pineapple Plantations, Woombye District.

Pineapples.

The pineapple is the major fruit (Table 2) grown in the district and the industry contributes a great deal to closer settlement. The Maroochy Shire in particular is one of the most closely settled rural areas in the State and this is largely due to the fact that the pineapple crop when properly handled enables a man and his family to obtain

a good living from a comparatively small area. Pineapple farms (Plate 155) generally average 20-25 acres, of which approximately 15 are suitable for the crop. Of these 15 acres five or six would be in full bearing, and smaller areas planted but not bearing or lying fallow. A farm of this size with an average house, packing shed and the usual farm implements would at present cost from £4,000 to £4,500.

The principal variety now grown is the Smooth Cayenne, which is suitable for both the cannery and fresh fruit markets. Rough leaf varieties are grown only on a small scale and exclusively for the fresh fruit market. Woombye is the centre of this flourishing industry and has maintained its position as the largest single pineapple producing area in the State since the crop was first planted more than seventy years ago. Since pineapples were introduced to Woombye, the industry has spread and is now well established at Palmwoods, Nambour, Beerwah, Glasshouse Mountains, Elimbah, Caboolture, Wamuran, Blackall Range, Buderim, Cooroy, Mary Valley and Gympie. In this district there are some 1,100 growers producing more than 1,000,000 cases of fruit annually, and there is no doubt that the output could be increased a great deal.

Production over the years has been maintained and increased through the operation of several canneries in Brisbane which handle surpluses over fresh fruit market requirements. Recently, pineapple growers established a co-operative cannery at Northgate and this should further stabilise the industry in the future.

Bananas.

The banana industry in coastal districts south of Brisbane received a severe setback from the virus disease bunchy top in the period 1920-25. The North Coast then became the main producing area in the State. Large areas of virgin scrub land were cleared and production from the district was phenomenal for about ten years. However, the rehabilitation of the industry in bunchy top infected areas, combined with severe losses from banana rust thrips around Gympie, caused a reduction of the area under crop in the North Coast district. The industry then went through a difficult period. Little new scrub land was available, but reasonable stability was achieved when methods of commercially producing bananas on open forest country were developed. As these soils are less fertile than virgin scrub land, artificial fertilizers have to be used and cultural methods must be efficient. One significant change was the introduction of the one-bunch-one-follower system of management, which has since proved its value both on the North Coast and in other banana growing areas of the State.

Bananas (Plate 156) are now grown on a variety of soils ranging from red basaltic loams to grey sandy loams, the main centres of production being Caboolture, Wamuran, Mooloolah, Eudlo, Palmwoods, Buderim, Eumundi, Cooroy and Gympie. Dwarf Cavendish is the main variety, but Mons Mare, a sport which originated from Cavendish at Buderim, is gaining popularity. The Lady Finger banana is grown extensively at Buderim and also on some alluvial flats where the risk of frost is not excessive. Small areas of William's Hybrid, Sugar and Ducasses bananas are in production. The future prosperity of the

industry in the district depends on the growers' ability to maintain soil fertility on forest soils and the practicability of reconditioning scrub soils for new plantings.

Plate 156.

Portion of a 20-acre Mons Mare Banana Plantation at Yandina, showing the One Bunch One Follower System of Management.

Citrus.

The citrus industry was established some fifty years ago at Buderim, and at Montville, Flaxton and Mapleton on the Blackall Range. The Blackall Range, with its undulating country carrying large acreages of citrus trees on a red basaltic soil, presented a fine picture. During the early 1930's, prices for citrus fruit were low and many orchards in full bearing were destroyed to make way for the pineapple crop, which offered better prospects at that time. Citrus is now being grown in all parts of the district. Some of the better orchards are provided with irrigation facilities and it is probable that others will be so equipped in the future. The principal varieties are Washington Navel, Joppa and Valencia Late oranges, Emperor and Glen Retreat mandarins and Marsh grapefruit.

Citrus orchards are subject to the usual wide range of pests and diseases which occur in coastal areas, and as summer rains often interfere with spray programmes, control is far from easy. Nevertheless, the North Coast is still one of the largest citrus producing districts in the State, and is favoured by its proximity to the Brisbane market There are many unused areas of land suitable for the crop in the Beerwah, Glasshouse Mountains, Caboolture and Wamuran areas, so there is ample scope for expansion.

TABLE 2.

HORTICULTURAL PRODUCTION—NORTH COAST DISTRICT (1948-49).

FRUIT.

Crop.	Not Bearing.	Bearing.	Production.
Citrus—	Trees.	Trees.	
Navel oranges	11,914	10,875	16,262 bushels
Valencia oranges	15,701	22,355	38,348 bushels
Other oranges	16,952	29,536	57,744 bushels
Mandarins	10,637	24,075	45,890 bushels
Other citrus	4,416	7,465	12,833 bushels
Custard apples	1,114	525	1,369 bushels
Mangoes	794	1,115	1,845 bushels
Nuts	2,907	8,043	68,395 lb.
	Acres.	Acres.	
Bananas	1,258	2,580	195,057 1¼ bushel cases
Pineapples	1,737	4,576	13,289 tons (factory) 542,087 1¼ bushel cases (fresh fruit)
Papaws	57	143	37,761 bushels
Passion fruit	19	19	2,045 ½ bushel cases
Strawberries	..	90	232,755 lb.

VEGETABLES.

Crop.	Area.	Production.
	Acres.	
Potatoes	335	544 tons
Sweet potatoes	33	134 tons
Turnips	4	15 tons
Carrots	19	523 cwt.
Beetroot	5	115 cwt.
Tomatoes	104	18,840 ½ bush. cases
French beans	2,137	219,775 bushels
Green peas	95	4,737 bushels
Cabbages	15	3,755 dozen
Cauliflowers	15	2,211 dozen
Lettuces	2	612 bushels
Melons—Water	40	174 tons
Rock	5	6 tons
Pumpkins	205	590 tons
Marrows and squashes	11	39 tons
Cucumbers	140	13,115 bushels

Papaws.

At the present time, papaws are grown in many parts of the district though usually on a small scale in conjunction with other more important crops such as pineapples and bananas. The papaw is highly susceptible to frost injury and plantations are, therefore, limited to those areas which are free from frost and reasonably well protected from strong winds.

Considerable attention has been given to papaw improvement projects during recent years. Seed of two new varieties, Bettina and Improved Petersen, was made available to growers in 1949 and arrangements are being made to supply all grower requirements in the future. This development should effect an improvement in the quality of the fruit marketed from 1951-52 onwards. Steps are also being taken to develop varieties more resistant to ripe rots, so that the fresh fruit market in southern States can be adequately supplied. At the present time, there is an increasing demand from canneries for papaw fruit and this outlet does much to stabilise the industry.

Ginger.

Commercial ginger growing commenced at Buderim about 20 years ago, but the industry made little progress until the commencement of World War 2, when overseas supplies ceased. The erection of a co-operative factory at Buderim has stabilised markets and permitted further expansion of the area under crop. Ginger (Plate 157) requires a comparatively heavy soil and can be grown in areas subject to frost, for growth takes place during the summer months and the rhizomes are harvested in autumn. Ginger growing has spread from Buderim to Woombye, Nambour, Eumundi and Cooroy during recent years, and approximately 650 tons are produced and treated annually.

Plate 157.

A Stand of Ginger at Buderim. Note drainage trenches and the use of mulching material between the plants.

Avocadoes.

Seedling avocadoes were grown at Woombye fifty years ago and a number of these original trees are still bearing fruit. Though the fruit from seedling trees is suitable for local consumption, it is of little value for large-scale marketing. Consequently, as commercial production developed during the past twenty years, the area under good varieties such as Fuerte, Nabal and Anaheim has increased, the emphasis being on worked trees. However, there is still scope for considerable expansion.

The avocado, though well known in the North Coast district, is a novelty to the consuming public in the larger cities. Considerable publicity is needed to educate the consumer in the value and use of this nutritious fruit.

Strawberries.

The strawberry industry was originally centred on Palmwoods, Eudlo and Buderim, and catered for a fresh fruit market. During the past twenty years it has expanded to Woombye, Nambour and Gympie. Jam factories are now absorbing much of the increased production.

The main varieties grown are Phenomenal and Aurie, with the former predominant. The crop is affected by two virus diseases, yellow edge and crinkle. An approved runner scheme is operated by the Department of Agriculture and Stock to ensure that runners from disease-free crops will be available to growers.

The crop grows on a wide range of soils mainly in areas where irrigation is practicable. A considerable amount of labour is required in harvesting, and individual cropping areas are therefore relatively small, the crop being invariably grown in conjunction with other fruits. There is ample land for further expansion, but limiting factors are shortage of labour for harvesting and scarcity of good planting material.

Passion Fruit.

Passion fruit grows well in the district and can be a very profitable crop. Due to the incidence of diseases such as woodiness and brown spot, the plant is rather short-lived and goes out of production within four years. The scarcity of wire and the cost of trellising generally, combined with disease control problems, greatly reduce the prospect of any early expansion in this industry.

Nuts.

Both pecan and Macadamia (Queensland) nuts are grown on the North Coast. The pecan does particularly well in the deep soils and can withstand light frosts, so that it may be grown on the lower portions of many farms. The Macadamia nut, which is indigenous to the rain forests of southern Queensland, grows well under cultivation and is usually planted on the more broken ground which is not suitable for crops requiring intensive cultivation.

Beans.

Beans are grown extensively as a winter crop throughout most parts of the district from April to September. The plant thrives on a variety of soils provided they are not too acid, but careful selection of the area to be cropped is necessary, the main factors requiring consideration being freedom from frost and protection from strong winds. The principal variety is Brown Beauty. It has proved very suitable for southern markets, which are short supplied when colder areas cease production.

The bean industry is valuable to the North Coast district. Some growers specialise in the crop but many treat it as a sideline to be grown during the winter months when maintenance work on pineapple or banana plantations is comparatively light. It is a quick cash crop and a very desirable one provided adequate labour can be secured for harvesting.

Formerly the crop was grown under natural rainfall, but more and more growers are now using irrigation, particularly in the northern part of the district. This development has reduced much of the uncertainty formerly associated with the industry and crop yields are sometimes extremely high.

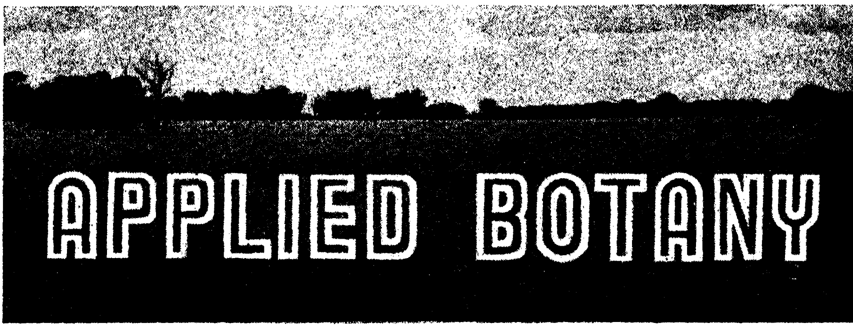
Plate 158.
A Good Crop of Brown Beauty Beans in the Woombye-Palmwoods District.

Other Vegetables.

With the exception of beans, the North Coast is not a commercial vegetable growing district, but it is capable of producing excellent tomatoes, cabbage, cauliflowers and other crops, particularly in the Mary Valley. At present, however, these crops are produced on a small scale only for domestic consumption and local markets.

Future Prospects of the District.

For many years there was a feeling of insecurity in the district, due largely to frequent over-production for the fresh fruit market. Often the prices realised were not sufficient to adequately cover costs of production and there was, therefore, little encouragement for rapid expansion. Now organised marketing systems and the establishment of co-operative factories capable of processing surpluses at a price profitable to the grower have stimulated production and there is every reason to expect a steady increase in the area assigned to the more important fruits for which there is now a reasonably assured market.



Purple Thorn Apple and Hairy or Recurved Thorn Apple.

Prepared by the Botany Section.

FOR some time common thorn apple or stramonium (*Datura stramonium*) and fierce thorn apple (*Datura ferox*) have been declared under the Local Government Acts as noxious weeds throughout the State. At the request of various bodies, purple thorn apple (*Datura tatula*) and hairy or recurved thorn apple (*Datura metel*) have been added to the list of declared noxious plants. The following illustrated account of these two weeds has been prepared with the object of enabling shire councillors, employees, and landholders in general to identify them.

PURPLE THORN APPLE (*Datura tatula*).

Description (*See Plate* 159).—A coarse, ill-scented weed of annual growth. Stems deep purple. Leaves irregularly cut and toothed, dark green, on short leaf stalks; leaf stalks and principal veins deep purple. Flowers purple or lavender, paling to white in the throat; trumpet-shaped; solitary in the forks of the branches. Seed capsule egg-shaped or somewhat pyramidal when mature, opening at the top into four valves. Seeds numerous, dark brown or blackish, flat and wrinkled.

Distribution.—It is widely spread over the whole world with the exception of the cold temperate regions. Like many other widely distributed plants, its country of origin is doubtful. In Queensland it mostly occurs as a weed of cultivation areas and of vacant allotments around towns.

Properties.—All the thorn apples must be looked on with suspicion. Purple thorn apple is little more than a colour variant of common thorn apple and possesses the same properties. It is poisonous but is usually left untouched by stock. Drying does not destroy the poisonous properties and most of the cases of stramonium or thorn apple poisoning that occur in Queensland are from feeding contaminated chaff. Both seeds and leaves are used medicinally.

Plate 159.
Purple Thorn Apple.

HAIRY OR RECURVED THORN APPLE (*Datura metel*).

Description (see Plate 160).—A tall, robust weed. Stems and leaves softly hairy. Leaves mostly 4–5 inches long and 2–3½ inches across, apex pointed, base usually very unequal sided, margins often wavy edged. Flowers white, large, and trumpet-shaped. Seed capsule globular, large (about 2 inches in diameter), reflexed (nodding), prickly.

Plate 160.
Hairy or Recurved Thorn Apple.

Distribution.—A native of tropical America, now widely spread over the warmer regions of the world. In Queensland it mostly occurs as a weed of roadsides and waste places about towns.

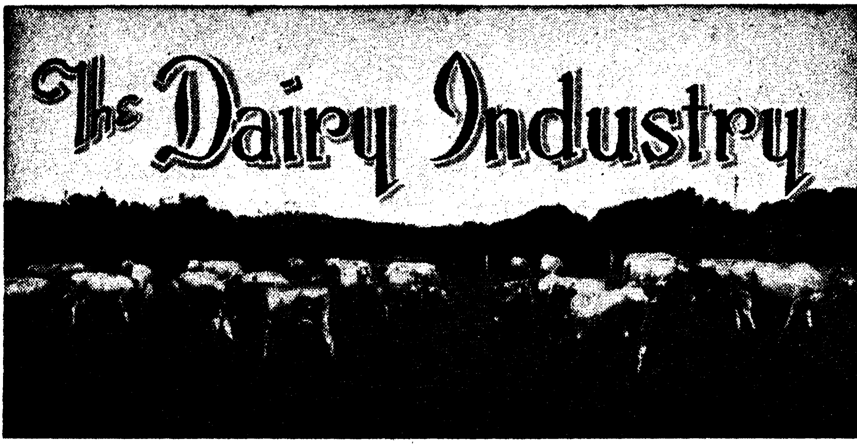
Properties.—Like other species of Datura it is poisonous, but is usually left untouched by stock. Being mostly a weed of roadsides and vacant allotments it is not so often a contaminant of chaff and hay as some of the other Daturas.

Eradication.

Hand-pulling, chipping, or mowing the plants before they seed will eradicate these weeds if persisted with. 2,4-D sprays have given very variable results and cannot be recommended. Recent work with the hormone weed killer 2,4,5-T suggests that at least one of the Daturas is fairly readily killed by spraying with a 0·1 per cent. emulsion of 2,4,5-T at a rate of application of about 140 gallons per acre.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 19th SEPTEMBER, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
A.I.S.	F. B. Sullivan, "Fermagh," Pittsworth
	D. Sullivan, Rossvale, *via* Pittsworth
	W. Henschell, Yarranlea
	Con. O'Sullivan, "Navillus Stud," Greenmount
	H. V. Littleton, "Wongalee Stud," Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Kingaroy
Ayrshire	L. Holmes, "Bencecula," Yarranlea
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman
	J. F. Dudley, Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, *via* Rosewood
	J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount
	J. F. Lau, "Rosallen Jersey Stud," Goombungee
	G. Harley, Hopewell, Childers
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, Crawford, Kingaroy Line



Erection of Power Sprays in Relation to the Dairy Premises.

J. D. ELRINGTON and S. W. IVERS, Division of Dairying.

ENQUIRIES have been received from a number of dairy farmers as to whether it is permissible to use a power spray for the control of cattle tick in conjunction with the existing installations at the cow yards and milking sheds. The use of the milking machine engine as motive power would save the farmer considerable expense, and for this reason requests have received sympathetic consideration.

The advantages claimed for a power spray are:—

1. It is more convenient to use. The cattle simply walk through the spray instead of being forced to swim through a plunge dip.
2. There is little risk of physical injury to the cattle.
3. Overheating and undue excitement are eliminated.
4. Loss of production is negligible.

The Dairy Produce Acts, 1920 *to* 1944 prescribe that certain requirements must be complied with for dairy yards, buildings and surroundings, and as long as these requirements and strict hygiene are observed, there can be little possibility of a power spray affecting the quality of the dairy produce. The relevant requirements are that stock must not be allowed to approach within 30 feet of the dairy house in which cream is stored and that there shall not be an accumulation of manure within 130 feet of the dairy house or 100 feet of a milking shed.

Layout.

Field officers of the Division of Dairying have suggested a number of layouts which would permit a power spray utilising the milking machine engine as motive power to be operated in close proximity to the milking shed without infringing the provisions of the Dairy Produce Acts and Regulations. Selected suggestions on layout are included in the design given in Plates 161 and 163 for the guidance of farmers who may be contemplating the installation of such a plant.

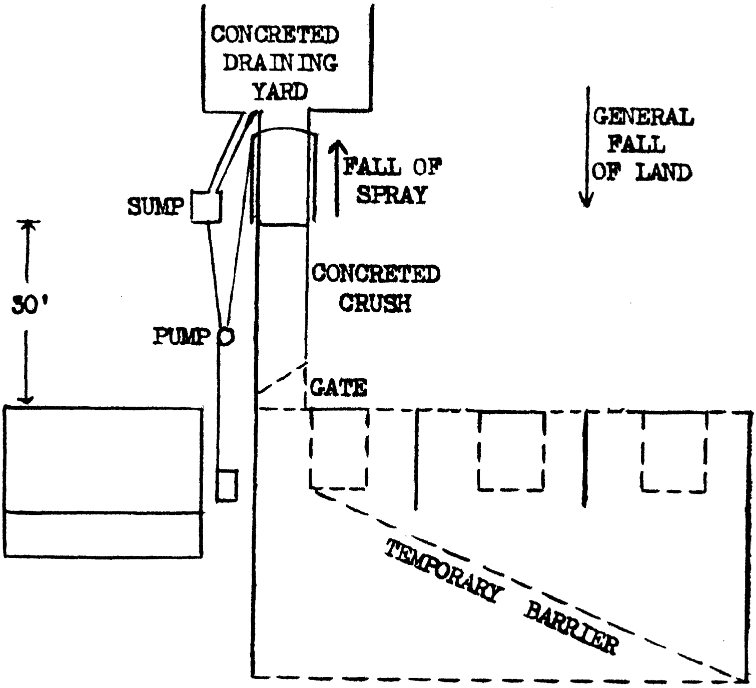


Plate 161.
A Suitable Layout (No. 1).

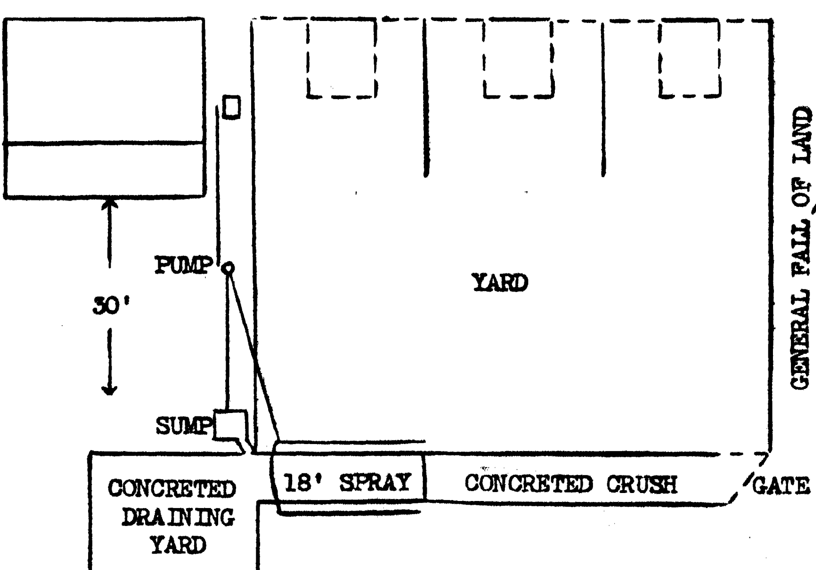


Plate 162.
A Suitable Layout (No. 2).

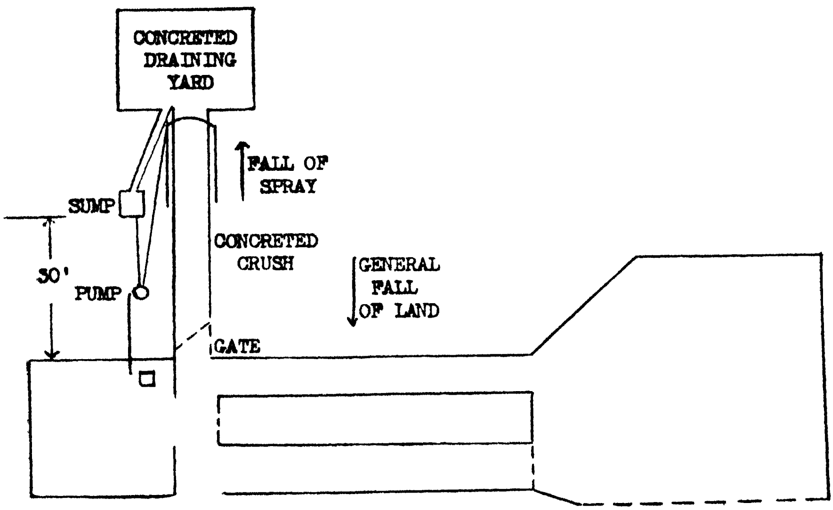


Plate 163.
A Suitable Layout (No. 3).

The mechanical points to be considered are the relative positions of the engine, pump, tank and spray, the drain from the spray back to the spray-fluid tank, and the speed of the pump. Obviously, the spray and tank must be outside the 30-ft. stock-free area, and the race, spray and drain yard concreted. As the pump travels at 2,000 revolutions per minute, it would be desirable to drive it with a belt direct from the engine, which revolves at approximately 1,000 revolutions per minute, the reason being that a 27-inch pulley (depending on the revolutions per minute of the countershaft) would be required on the countershaft. The drive is easily arranged by installing the pump approximately 10 feet from the engine, which is fitted with a pulley of appropriate size, or a pulley of correct size may be fitted to work off the pulley already on the engine. The correct size of pulley may be ascertained from the formula:—

$$\text{Diameter of pump pulley in inches} = \frac{\text{Engine speed (RPM)} \times \text{Diameter of engine pulley in inches}}{\text{Pump speed (RPM)}}$$

If the maker supplies a pump and pulley complete, and the farmer is prepared to change the engine pulley for each spraying, the required size of pulley can be found from the following formula:—

$$\text{Diameter of engine pulley in inches} = \frac{\text{RPM of pump} \times \text{Diameter of pump pulley in inches}}{\text{RPM of engine}}$$

Extra pipeline will be required from the tank to the pump and from the pump to the spray. Friction losses in this extra pipeline are negligible, the important point being the height of the pump vertically above the level of the liquid in the tank. If the site is a good one, then a natural fall of the land can be used to advantage here. In the installation shown in Plates 164 and 165 the pump is actually below the level of the liquid in the tank, which is desirable. It will also be noted that in this installation the pump is driven from the countershaft, but the owner of this power spray, who is content to drive the pump slower than the recommended speed, assured the writers that he obtains satisfactory results.

Plate 164.
Showing How Natural Fall of the Land Can be Used to Facilitate Pumping.

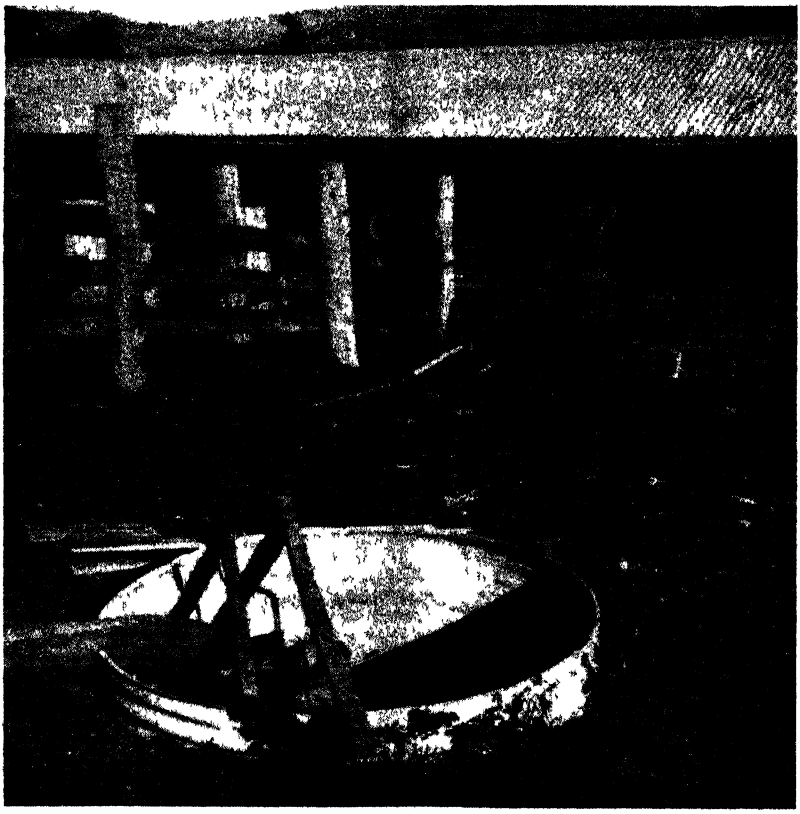


Plate 165.
An Installation in Which the Pump is Driven from the Countershaft.

The plans in Plates 161 and 162 are for use with the "walk through" type of bail, while that in Plate 163 is for use with the "crush type of bail.

In the first plan it would be more convenient to build the drain from the bail end of the spray. However, as the cattle tend to jump over the drain full of spraying solution when entering the spray, it is considered desirable to excavate for the spray and build the drain as shown. The cattle will then walk quietly into the spray and out the other end.

Briefly, a power spray installation consists of a crush and holding yard (Plate 166). The crush portion is usually 18 feet or 36 feet long. The smaller size is for handling up to 80 head and the larger one for larger herds. In the crush are patented spray nozzles (Plate 167).

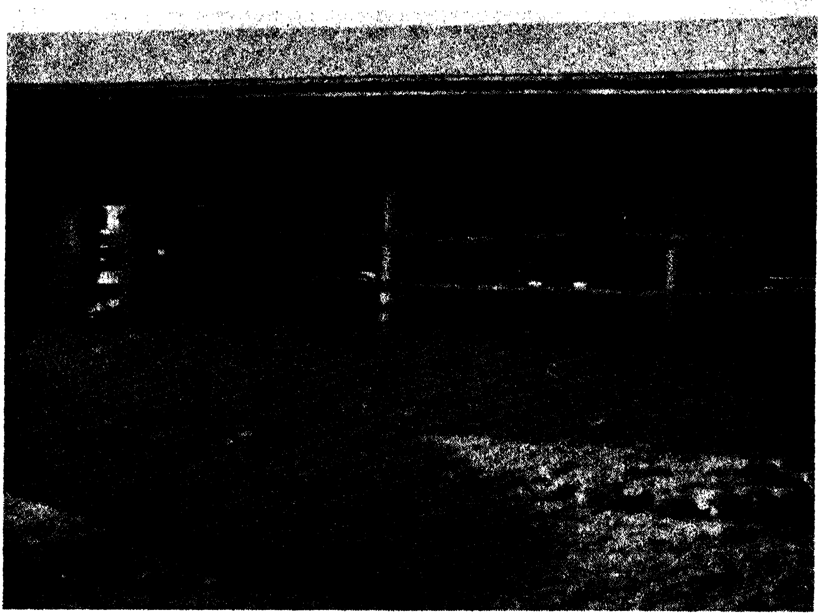


Plate 166.
A Temporary Barrier Erected Across the Holding Yard.

Spraying.

Spraying solution is forced under pressure through the spray nozzles, where it is diffused into a fine spray. The cattle pass from the crush to the draining yard. Excess fluid from both the draining yard and the crush portion runs back to a sump which is connected to the pump and so the fluid is kept circulating. One major problem has been the clogging of the spray nozzles by the dirt and hair washed off the cattle finding their way back to the pump by way of the sump. Originally, a trap was tried for arresting this, but this has now been superseded by a more efficient strainer and screen arrangement (Plate 168). It is important that this be kept free and not permitted to overflow, otherwise clogging will again result.

Plate 167.
A Crush Equipped with Special Spray Nozzles.

There are a number of parasite-control preparations suitable for use in a spray plant. These preparations need special techniques to ensure maximum results; the latest information on various spraying solutions can be obtained from the local Inspector of Stock or the manufacturers of the different products.

The cost of installing a power spray ranges from £100 upwards. However, the cost can be reduced by the farmer himself providing labour and some materials and using the milking machine engine in preference to purchasing a new one.

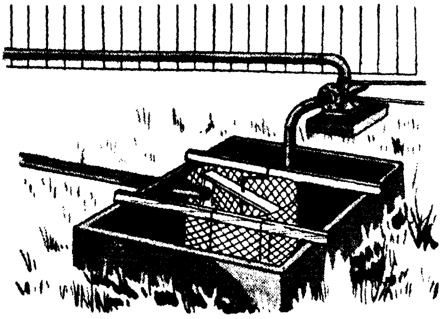


Plate 168.

Diagram of Strainer and Screen Arrangement for Cleaning Spray Solution.

Official Advice Desirable.

In conclusion, it should be pointed out that any farmer who erects a power spray plant adjacent to his milking shed must see that it is operated and kept in a condition which will obviate any risk of contamination of dairy produce. If it is desired to use the milking machine engine as motive power for the spray, the layout should be in accordance with the suggestions contained in this article, and the advice of the local Dairy Officer should be sought before construction is proceeded with.

JUNIOR FARMERS AT THE BRISBANE SHOW.

Much greater interest was displayed by members of Junior Farmers' clubs at this year's Brisbane Exhibition than on previous occasions, as in addition to the fifteen boys selected to constitute the Royal National Association's "camp" held on the showgrounds, many outside club members were in attendance each day.

Ten girl members also attended for the purpose of taking part in the Australian Broadcasting Commission's annual "leadership" contest to select the champion junior farmer girl of Queensland for 1950. This coveted honour went to Mavis Sandilands, of the Warwick club, who defeated Audrey Taylor (Warra) and Ruby Gierke (Helidon), who tied for second and third places. The two remaining competitors in the final "test" were Marlene Fiedler (Gayndah) and Priscilla Smoothy (Crow's Nest), who tied for fourth and fifth places.

Among the boys attending the special R.N.A. "camp" at the showgrounds, Ron. Elliot, of the Monto Club, secured first place in the non-competitive dairy cattle judging competition for junior farmers, with Ron. Duffy (Malanda) and Wm. Balooda (Goovigen) being placed second and third respectively. In the official (or competitive) section open to all young judges, Jim Savage, a member of the Gayndah club, gained first place in the A.I.S. Section, as well as winning the "Phillip Frankel Young Judges' Extension" competition.

John Letchford, of the Theodore club, was selected to represent the Junior Farmer organisation at the ceremony of "Blessing the Plough," held in the early part of show week. Mr. C. V. Lilley (assistant organiser in Queensland), acted as camp manager and supervisor during the absence of the State Director (Mr. T. L. Williams) on this occasion.

Observations on the Management of Sheep Properties on the Central Highlands.

1. Sheep Grazing on Summer Crops.

J. N. REA and G. R. MOULE, Sheep and Wool Branch.

INTRODUCTION.

DURING the last decade there has been a gradual decrease in sheep numbers on the Central Highlands, which include the Emerald, Clermont, and Springsure districts. There are probably several reasons for this, including difficulties associated with shortage of labour, the prevalence of predators and of parasites affecting sheep, and deterioration in the natural pastures. Due to dry seasons, heavy stocking, and burning, the more nutritious grasses and ephemerals, which were dominant, are now less numerous in some pastures than mint weed, spear grasses, and other less useful species. In addition, the opinion is often expressed that the Central Highlands cannot be regarded as breeding country, and low lamb-marking percentages and retarded growth rates of young sheep are cited as evidence supporting this claim.

At the same time, it must be fully realised that the Central Highlands district is going through a transition stage. Agriculture is being practised more widely and many property owners are seeking ways of incorporating agricultural practices in the management of pastoral properties. The way in which this can be done is described in this article.

Summer Crops Grown by Mr. F. R. Vellnagel, Emerald Downs.

Emerald Downs is situated three miles north of Emerald and consists of about 10,700 acres of well shaded, undulating black soil downs, interspersed with loamy ridges of lighter textured soil. The principal trees are brigalow, box, coolibah, ironbark, and softwoods such as bottle tree, yellow wood, bauhinia and wilga. The natural pastures include button, star and barley grasses and some curly Mitchell, Flinders and blue grasses. White spear grass and feathertop are now the most common species and they are showing signs of increasing. The

ephemerals include carrot, pigweed, fat-hen and saltbush. These are predominantly summer species and feed is usually deficient in quantity and quality in the winter.

Apart from milking cows and working horses, the property is now carrying about 4,000 Merino wethers of mixed ages. Although the size of the flock has varied, the property has always been used for dry sheep.

At the present time about 1,145 acres are under cultivation and Mr. Vellnagel has concentrated on summer crops. In 1949 he grew 180 acres of Sudan grass and the remainder of the arable land was used for grain sorghum, which yielded up to 35 bushels per acre.

As the sorghum was essentially a grain crop, interest centres around the 180 acres of Sudan grass. This was sown at the rate of 5 lb. per acre in a 400 acre paddock from January 17 to January 19, 1949. Monthly rainfalls for that year and 1950 are set out in the following table:—

1949.	Points.	1950.	Points.
January	209	January	431
February	594	February	594
March	783	March	375
April	Nil	April	746
May	32	May	244
June	22	June (till 17th June)	129
July	5	Total	2,519
August	22		
September	77		
October	630		
November	288		
December	42		
Total	2,704		

Two germinations of Sudan grass seed occurred. In the first a 20 per cent. strike was observed and the balance germinated during the February, 1949 rains. A good number of young plants from this germination were lost, as they were grazed during the early stages.

The sheep had access to the whole of the 400 acre paddock whenever they were allowed to graze the crop. It included a light loamy ridge which carried very little feed during the winter and some black soil covered with star grass and feathertop.

The paddock was heavily grazed from the last week of February, 1949 until the spring. Three thousand five hundred wethers were on the crop from the last week in February to the end of March. A further two thousand were then added, and the whole flock was withdrawn during the third week of May. The paddock was then spelled for three weeks and was subsequently grazed by 10 house cows, the working horses and a smaller flock of sheep, whose numbers never exceeded 1,400, until September 10. The paddock was then spelled again for four weeks, when up to 1,700 wethers were re-introduced and were carried until the end of November.

During the later periods, that is, between June and November, 1949, various drafts totalling 1,700 aged, broken mouth wethers were fattened and sold. One draft, bought locally, dressed out at 48 lb., while another draft of 800 dressed out at 47 lb. in Rockhampton.

A further 3,500 wethers were grazed from the beginning of December, 1949, until the last week in April, 1950, when an additional 1,400 wethers were purchased and run with the flock, making a total of 4,900 sheep from the end of April till June 1.

At all times during 1949 when rain of sufficient quantity fell to endanger the crop by grazing with sheep, the stock were removed from the paddock and returned again when the ground had dried sufficiently. During the wet weather in 1950, the sheep were given access to a further 500 acres of grassland, but had to water in the paddock with the Sudan grass. They were continually brought in contact with the crop, with the result that the Sudan grass was eaten out completely.

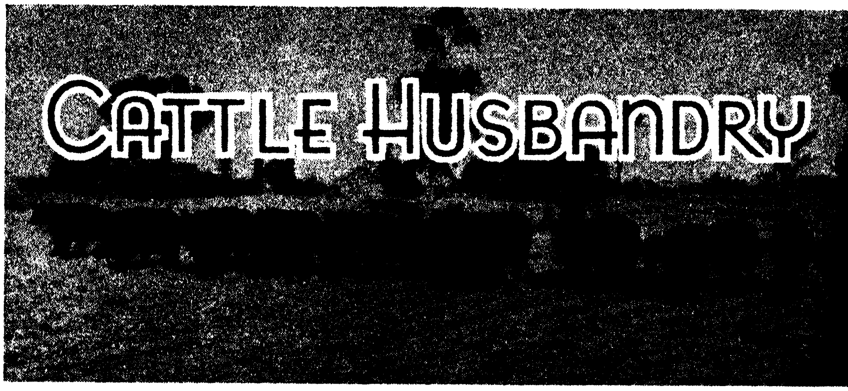
On June 1, the mob of 4,900 were shifted to a 200-acre paddock of sorghum stubble, which was grazed until June 13, when the flock again returned to the Sudan grass paddock. During this time the Sudan grass had re-established and grown to a height of 12 to 13 inches as the result of the mild, moist winter. In some areas, it constituted a thicker stand than in the previous year.

The actual value of this 180 acres of Sudan grass would be hard to assess, as the sheep were being grazed during periods when the natural grasses in other paddocks were allowed to re-seed. The fattening of aged, broken-mouthed wethers during the dry, harsh winter of 1949 could certainly not have been achieved on natural pastures. The wool return from sheep fed a more balanced yearly ration, and the accessibility of the sheep during the severe fly wave in the summer and autumn of 1950, are also to be considered.

No internal parasite trouble was experienced during the whole period and on no occasion were the sheep drenched.

SUMMARY OF GRAZING RATES.

Period.	Number of Sheep.	Stocking Rate in Sheep per Acre.	
		Paddock. (400 Acres.)	Crop. (180 Acres.)
1949—February-March	3,500	8·8	19·5
March-May	5,500	13·8	30·6
June-September	1,400	3·5	7·8
October-November	1,700	4·2	9·4
December-January (1950)	3,500	8·8	19·4
		(900 Acres.)	(180 Acres.)
1950—January-April	3,500	3·9	19·4
April-June	4,900	5·4	27·2
		Sorghum Stubble. (200 Acres.)	
1st June-13th June	4,900	24·5	



Dehorning of Cattle.

R. W. HEWETSON, Assistant Husbandry Officer, and C. R. MULHEARN, Divisional Veterinary Officer.

DEHORNING has now become a recognised practice in a great number of dairy herds in Queensland. Whilst dehorning is accepted as good husbandry by most commercial dairymen, many stud breeders, though recognising the economic advantages of dehorning, claim that the removal of horns detracts from the appearance of show animals. In fact, a dehorned beast is rarely seen in the showring.

The presence or absence of horns should not be allowed to distract attention from the points which really matter—the production of butter and meat, neither of which has anything to do with horns.

Farmers become accustomed to the sight of dehorned stock and soon appreciate the ease of handling and the freedom in moving among their dehorned cows. Breeders of polled cattle would not think their cattle improved if horns were grafted on. It is not horns which give Ayrshires a high place in the milk world, but good udder conformation and their ability to produce milk.

In the showring, attention should be concentrated on economic points, for after all, farming is a business. If the dehorning of cattle leads to greater production of milk and decreases the risk of injury in the yard, then dehorned cattle should not lose points when being judged in the showring.

It is claimed, by those opposed to the practice, that dehorning of adult cattle is cruel and for that reason should not be undertaken. Pain is certainly inflicted at the time of dehorning, but this pain, though acute, is fleeting and in no way as severe or as dangerous as that inflicted by cows ripping each other with sharp pointed horns. It is only necessary to see animals severely horned and trampled during trucking to realise the cruelty of enclosing aggressive horned animals in confined yards or trucks.

It is surprising that dehorning has not become a general practice throughout the world, as it has practically everything in its favour and if properly carried out, little against it.

ADVANTAGES OF DEHORNING.

The advantages of dehorning are summarised in this section.

More cattle can be kept in the dairy yard; they can be handled with less risk of personal injury; and the food is used more economically.

Cows are quieter in the yard when they are not expecting a horn "poke," and milking becomes quicker with less trouble in bailing up.

More cows can be put onto a limited grazing area, and strip grazing is more easily controlled. When the "boss" cow has horns she will frequently corner and rip a timid beast, and if this bullying goes on there will be a resultant depression of milk yield in some cows. Bullying is not unknown amongst hornless cattle, but usually with the loss of their horns, horned breeds lose their fighting instincts.

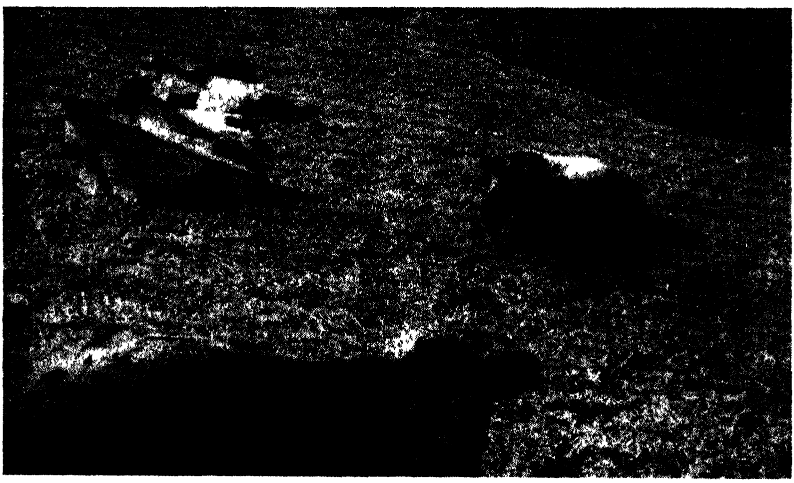


Plate 169.
Dehorned Dairy Cows Reclining Contentedly After Feeding.

Plate 170.
Dehorned Hereford Steers Grazing in a Small Oat Paddock.

Plate 171

An Easily Controlled Group of Dehorned Aberdeen Angus Cows and Calves.

When limited troughing space is available, it is frequently noted that some animals, as soon as they have satisfied their thirst, promptly attack their neighbours, causing injury to other cattle and to the troughing. This is eliminated if stock are dehorned.

During trucking of fat cattle, horning will cause marked depreciation of value of the carcases consigned to abattoirs, apart from losses due to tears in the hides. When trucking, it may be possible to include one more animal once they have been dehorned. Dehorned cattle can move their heads freely in a truck without the possibility of horns entering other cattle, with resultant injury.

As previously mentioned, a loss of horns causes an immediate change in temperament. Dairy cows, once dehorned, on being turned into a crop graze like sheep. They keep their heads down until they have eaten sufficient feed and then retire to the shade to ruminate.

Close concentration of cattle on a similar area allows more efficient grazing of pasture at its most nutritious stage of growth.

Bulls are a constant source of danger, particularly on dairy farms, where it is frequently necessary to work them through milking yards. Some breeds of dairy bulls, too, are temperamental and for that reason more dangerous than beef breeds. The removal of horns has a remarkable influence on the temperament of even the most vicious bull. For this reason dehorning of bulls in all dairy herds is strongly recommended.

ELIMINATION OF HORNS BY BREEDING.

The most satisfactory way of getting rid of horns is to breed them off, and this can be achieved, with beef cattle, if a certain breeding programme is followed.

Polledness is strongly dominant and polled sires will throw a large percentage of polled calves when mated to horned females. The first cross will all be polled. The second generation, if interbred, will produce roughly three polled calves to every one horned calf. This is represented diagrammatically in Plate 172.

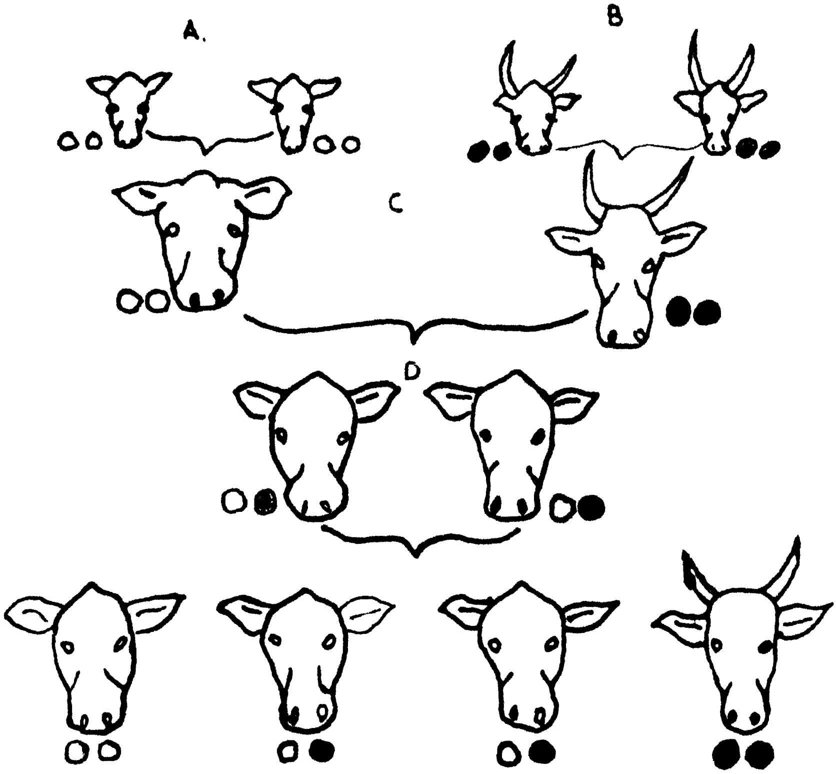


Plate 172.

Diagram Showing how Polledness is Transmitted.—The character for polledness is represented by an open circle and that for horns by a filled circle. At the top, two polled animals are mated to give a polled animal and two horned animals to give a horned animal. If these two animals are mated, they give polled offspring. Two such polled progeny when mated give three polled animals and one horned in every four on an average. Two of the polled offspring have the character for horns as well as for polledness, and though polledness is dominant in them, some of their progeny are likely to be horned.

However, if a sire which is pure for polledness is regularly used, all his progeny will be polled. Unfortunately, there are no recognised pure polled breeds of dairy cattle in Australia, and dehorning is necessary with this type of animal.

ANATOMY OF HORN AND POLL.

Before considering methods of dehorning, it is desirable to give some attention to the anatomy of the horn and poll. (Plates 173 and 174.)

Just below and on either side of the frontal eminence or poll is a "processus cornus," or horn core, for the support of the horns. Horn cores vary in size, shape, length and direction and are of elongated conical form.

The external surface is rough and porous, and marked by numerous grooves and holes for blood vessels. In the fresh state it is covered by the horn-forming cells, or corium, of the horn.

The interior is excavated to form a number of irregular spaces divided by bony walls and communicates with the frontal sinus, the whole space being lined with mucous membrane.

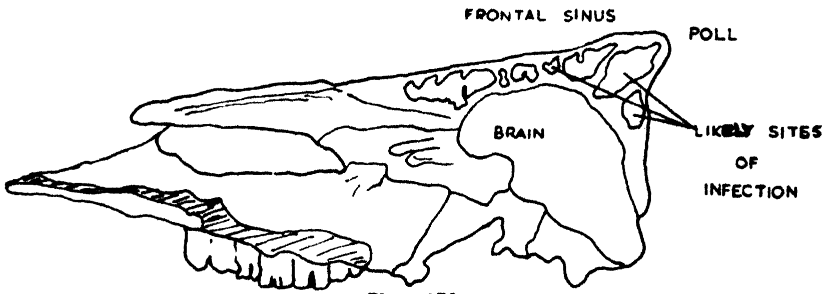


Plate 173.

Diagram Showing the Location of Sinuses in Relation to the Poll.

The nerve supply to the horn is by a branch of the lacrimal nerve which emerges from a foramen opening in the skull (Plate 174) above the eye and runs below a ridge running up to the horn, where it divides just under the skin.

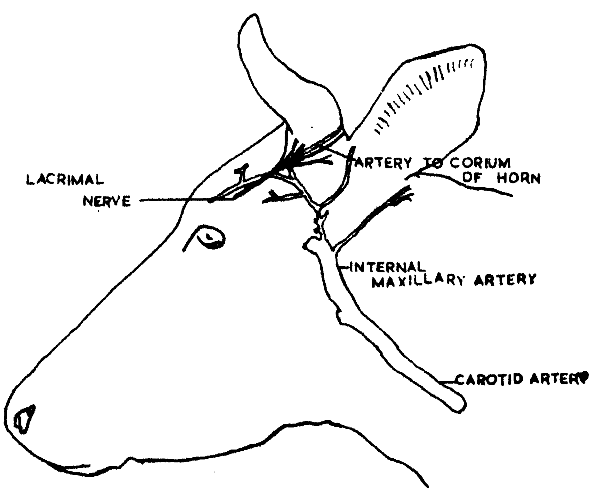


Plate 174.

Diagram Showing the Position of Nerves and Arteries.

The blood supply to the horn (Plate 174) is supplied by a special artery, the artery to the growing area of the horn, which is a branch of the internal maxillary.

The growing area of the horn can be compared to a similar growing area, the coronet, on the horn of the hoof. Once either of these is injured there will be no further growth of horn. If the growing area is not removed with the horn, it will result in ugly stubs growing later.

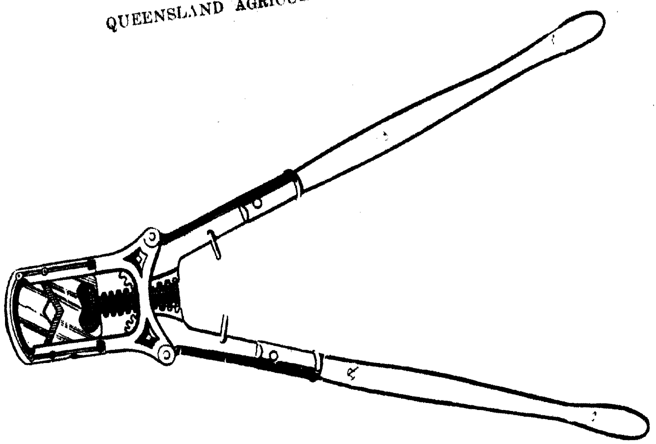


Plate 175.
A Suitable Dehorner for Adult Cattle.

Plate 176.
Dehorning with a Guillotine Dehorner.

DEHORNING OF ADULT CATTLE.

Guillotine Dehorner.

Best results are obtained when dehorning is undertaken on calves under six months old. At times it may be considered advisable to dehorn mature cattle, and a special large type of dehorner is necessary for this operation. Many dehorners are on the market, but only those which are massive and strongly built, and lend themselves to a prompt, clean removal of the horn in one movement, should be used. There is only one type of dehorner (Plate 175) which can be considered suitable for adult cattle. It is constructed on the principle of a guillotine and the blades, one of which is fixed, are in a frame. When the blades have been placed in the correct position, a quick purchase is obtained by closing the handles, which operate a rack and pinion gear. The blades overlap when closed and the horn comes off quite evenly.

Some form of restraint is necessary to ensure adequate control of the animal, and if a large number of beef cattle are to be treated, a special dehorning bail is essential (Plates 177 and 178).

When a horn is being removed, the anatomy of the region should be kept in mind and the dehorner so placed that approximately a quarter of an inch of hair and skin is removed with the horn. This destroys the growing area and ensures that there will be no regrowth of the horn. Bleeding may appear to be severe following dehorning of mature cattle, and although usually not considered dangerous, it is objectionable and may alarm the inexperienced operator. The bleeding can be controlled by the application of a ligature, tied around the base of the horn and across the top of the head and then twitched tightly by drawing the two pieces of the cord together across the top of the poll. This method of control should be employed with dairy cattle, but it is seldom used with beef cattle, owing to the necessity of re-yarding the animals to remove the ligature.

If the arteries are still spurting an hour after the operation, the animal should be caught and the haemorrhage stopped. This can be done by applying the ligature or by taking up the arteries with forceps and tying them off with cotton. If a sufficient amount of horn is taken, it is relatively easy to pick up the arteries with artery forceps and twist them off. Pliers will stop a spurting artery. If the ligature is not applied, the bleeding can be controlled to a certain extent by the searing iron, or by the use of a suitable powder. A dry dusting powder has been found more satisfactory for use immediately after dehorning than one with an oily or tarry base. Satisfactory application of the latter dressing is difficult. A suitable dusting powder may be prepared by mixing one part of boric acid, one part of zinc oxide, one part of powdered alum, and six parts of powdered starch.

Tipping.

Tipping is often practised as an alternative to dehorning in mature cattle, particularly bulls, dairy cows and forward steers. Tipping consists of the removal of about two inches from the tip of the horn, so that the "quick" or sensitive portion becomes exposed. It can be carried out with ordinary dehorners or with a saw. As a result of this operation, the extremity of the horn becomes tender for a considerable time and the animal will refrain from using it. Even when the tenderness disappears, the animal is less likely to be aggressive and cause ripping or bruising.

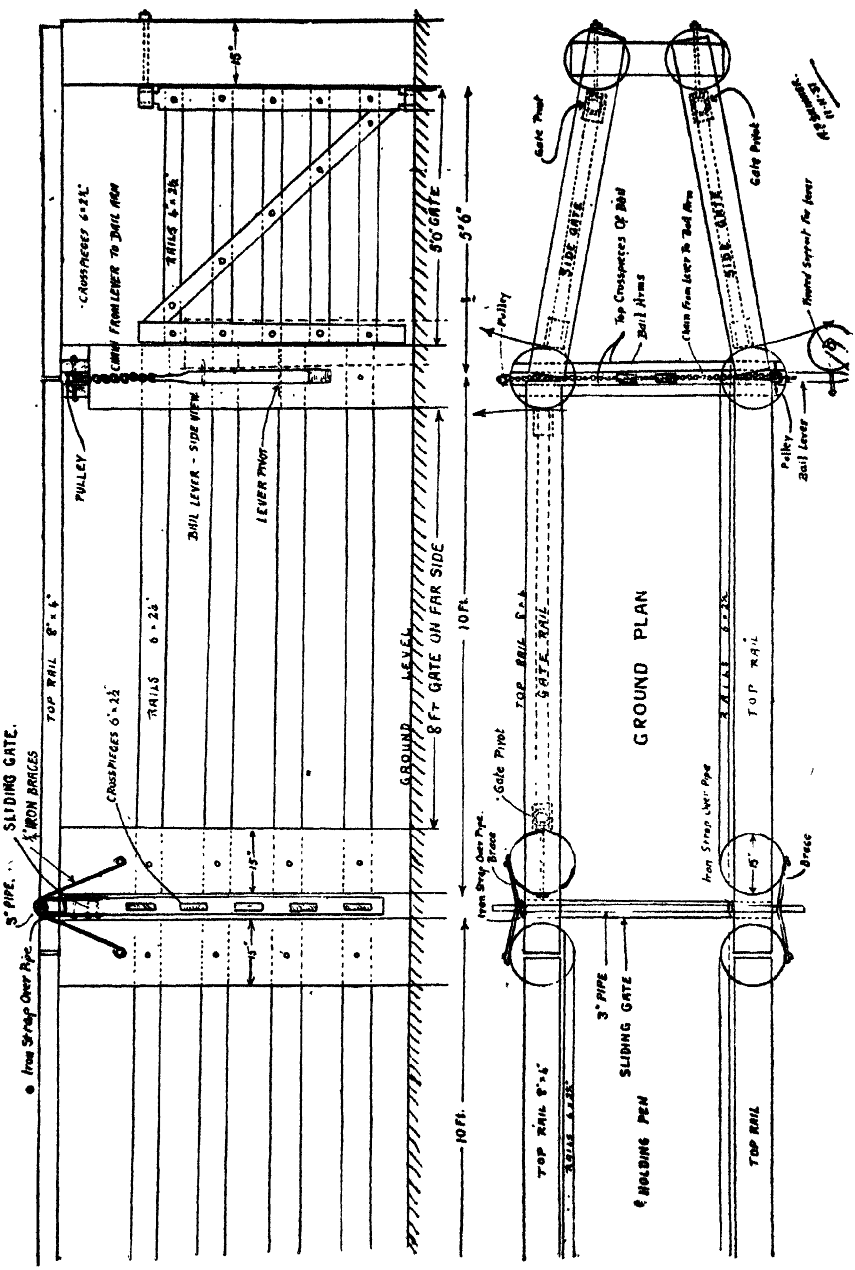


Plate 177.
Plan of a Dehorning Bail and Crush.

Time to Dehorn.

Dehorning is best done in the cooler months of the year when the fly population is at a minimum. Fly strike often follows dehorning in the hotter months when flies are bad.

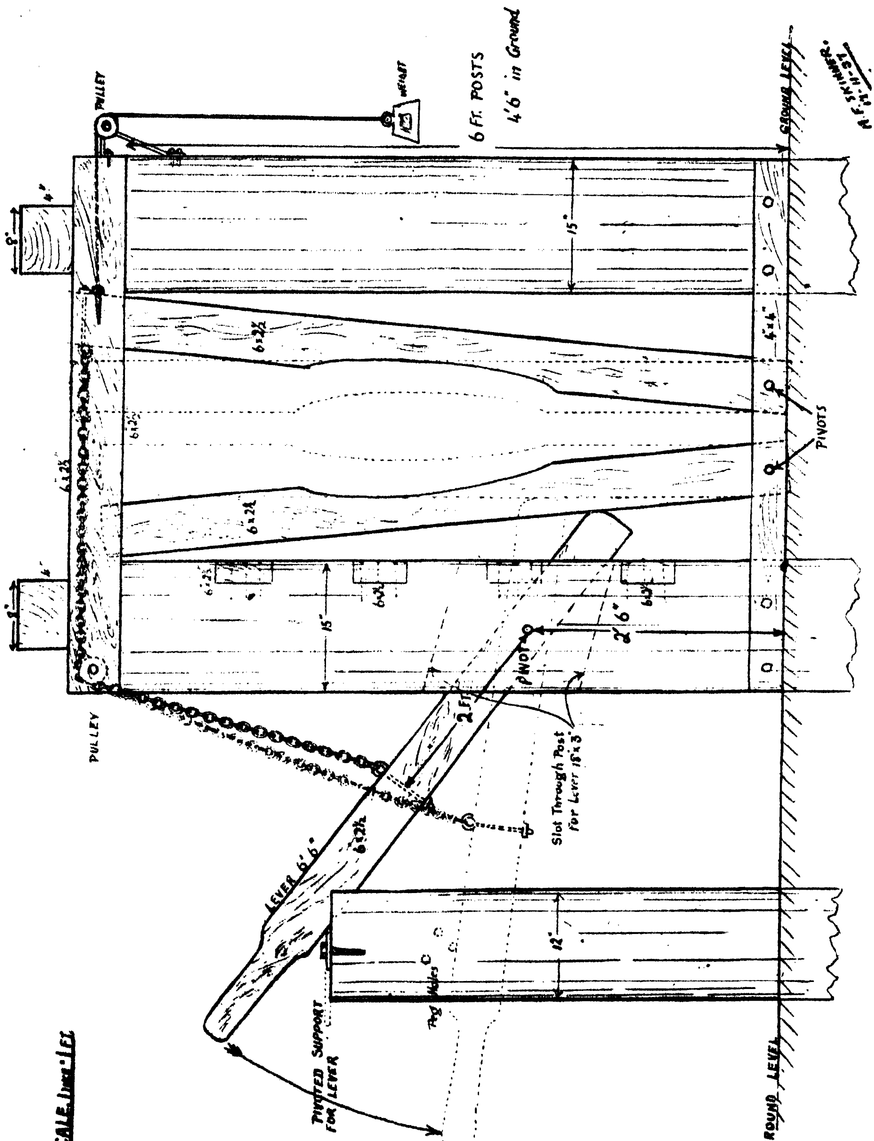


Plate 178.

Front View of the Dehorning Bail Shown in Plate 177.

Precautions and Aftercare.

Lysol is probably the best antiseptic to use. Instruments should be soaked for some hours previous to dehorning in 10 per cent. solution of lysol. A bucket of 2 per cent. lysol or dettol should be kept handy so that the dehorners can be immersed therein between operations. Suitable fly-dressings are B.K.B. and B.T.B., both of which are produced commercially, and oil of citronella, which has long been used as an insect repellant.

If fly strike is experienced, and a fly dressing applied, liquid should not be allowed to enter the sinus because of the risk of infection. If the sinus becomes infected, it is very slow to heal because of poor drainage.

Plate 179.
Result of Dehorning by Guillotine Dehorner Three Weeks After the Operation.

Plate 180.
A Typical Poll After Dehorning.

If, as sometimes happens when conditions are not ideal, fly strike is experienced, the hair around the horn should be clipped with scissors. It may be necessary to syringe out maggots with a weak antiseptic solution, tilting the head to make sure of drainage. A fly repellant is then applied.

DEHORNING OF CALVES.

There are three methods of dehorning calves, namely, chemical, cautery or hot iron, and mechanical.

Chemical Dehorning.

Caustic Sticks.—Calves up to two weeks can be treated with caustic soda or caustic potash. The latter is preferred, since caustic soda suffers from the disadvantage of having a tendency to spread, and thus to injure the surrounding tissues.

An area the size of a two shilling piece should be clipped over each "button"; a ring of vaseline about one inch wide is next smeared around the clipped area to check the caustic from running into the calf's eyes. The caustic stick is then moistened and rubbed over the button with a gentle rotary motion and the rubbing continued until blood just starts to seep through the seared spot.

Too little rubbing will leave unsightly "scars." On the other hand, too much caustic may cause excessive burning and scarring of the head. The caustic should only be applied to the area of skin covering the horn bud.

Plate 181.
Calf Dehorned at Birth With a Caustic Stick.

It must be borne in mind that caustic is injurious to skin and clothes and the user should either wear rubber gloves or use a paper wrapping for safe handling.

Afterwards, the calf should be tied up for at least six hours in a place where it cannot get wet. This will prevent scratching and rubbing of the treated area, which is likely to cause burning in other places and blindness if the caustic gains access to the eyes.

Antimony Trichloride.—In recent years, antimony trichloride in a solution of flexible collodion has been found to be a very satisfactory dehorning agent.

The solution can be made up by any chemist from the following formula:—

	Per cent.
Antimony trichloride	28
Salicylic acid	7
Flexile collodion	65

The material is easy to apply and the solution dries quickly into a firmly adhering flexible film which destroys the underlying tissue with much less pain than caustic sticks. Added to this, there is no danger of weeping fluid running into the eyes with resultant blindness.

The procedure is simpler than the application of other caustics. The hair around the buttons is clipped, the button cleansed with methylated spirit, and the solution applied. Using a brush, the mixture is applied to the centre of the horn, to cover an area the size of a sixpence. The animal need not be tied up or kept out of the rain. Again a little practice is required before complete success can be expected.

The solution gives best results if applied in the first nine days of life. After this period, it can be used fairly successfully if the top of the button is cut off with a pair of sharp (curved) scissors.

An alternative method of dehorning young calves is by the application of a special searing iron over the horn bud. This has become a popular method overseas. It is simple, efficient, safe and only slightly painful. A special debudding iron is used for this operation (Plate 182).

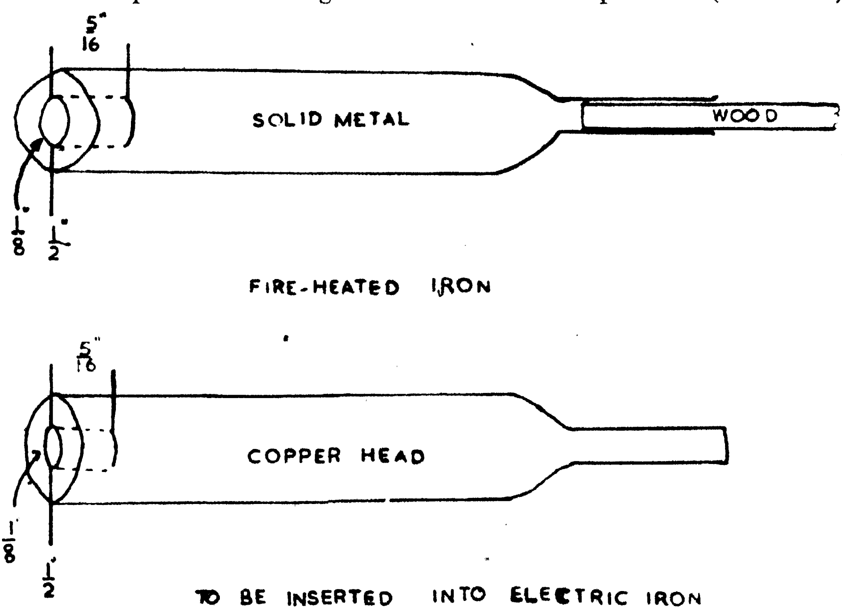


Plate 182.

Sketches of Debudding Irons.

The end of the iron is hollowed to form a dome shaped depression five-sixteenths of an inch deep in the centre and measuring half an inch across. This depression is surrounded by an outer ring of metal which is one-eighth of an inch thick and five-sixteenths of an inch deep, with an internal diameter of half an inch. The iron is mounted on a wooden handle for convenient use. If fire-heated irons are used, it may be found more convenient to have several irons with various sized cones suitable for calves of different ages. Whilst one iron is being used, the other iron could be in the fire heating. Dehorning by this method is best done at three weeks of age.

Electric soldering irons have been adapted to form efficient cauterisers (Plate 182).

With the calf suitably controlled, the iron, heated to a cherry red colour, is held over the developing horn bud to sear a complete ring

of tissue around it to prevent growth. It is here that the benefit of the wooden handle becomes apparent, for the iron is then turned completely around several times until the base of the horn is completely encircled by a copper coloured ring. The circulation to the horn is thus destroyed in less than thirty seconds and the horns drop off by themselves in due course.

There is no wound left for flies to enter and no risk of sinusitis.

Cautery would appear to be the best method.

Mechanical Methods.

Calves up to three months old may be treated by taking out the centre of the horn bud by means of a special instrument or a sharp knife. This may be followed with advantage by the application of a searing iron. When calves are approximately three months old, the horn core begins to grow out from the skull and horn removal then involves the opening of the frontal sinus. The size of the opening varies with the age of the calf, but it usually closes in from a week to a month, when the wound should be completely healed.

Special cup or scoop type dehorners are used and they are suitable for cattle up to 12 months of age.

The animal should be thoroughly restrained in a dehorning bail, or the special equipment used for branding beef calves, before the operation is attempted. The hair around the base of the horn should be clipped if it is long. The dehorner should be applied so that a quarter to a half inch of skin is taken with the "bite." The horn is removed in one movement by applying strong pressure on the handles of the dehorner. No dressing should be applied, except in a fly wave, when a fly repellant is used.

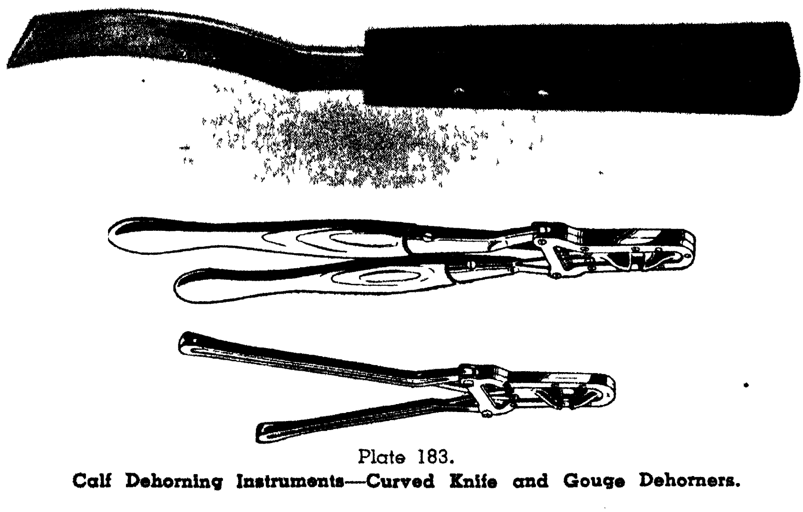
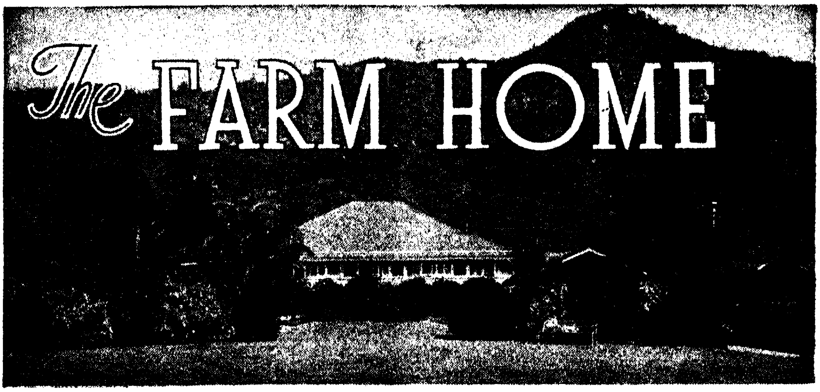


Plate 183.

Calf Dehorning Instruments—Curved Knife and Gouge Dehorners.

A specially adapted curved sharp knife (Plate 183) is used fairly extensively in beef herds. The horn bud is taken out with a clean cut of the knife.

Other mechanical means of dehorning include gouging forceps and gouging chisels, but these methods have nothing to recommend them when compared with cup dehorners.



Hints on Weaning.

WEANING means accustoming baby to new foods, or better still, helping baby to accustom himself to foods that have a different taste, sometimes a different smell and often a different consistency, from the milk he has taken previously; and the gradual substitution of these new foods for the familiar breast feeds.

The introduction of food other than milk into the diet of the baby marks an important stage in its upbringing, important alike to physical growth and to education, and it is of great benefit to baby if this process is accomplished gradually and smoothly.

In the building up of the mixed diet there are certain factors to be borne in mind. Milk remains the staple food for the first nine months of life, but it is generally recognized that probably from six months, and certainly from nine months, milk, unsupported by solid food, will produce a flabby infant with a liability to anaemia. If baby is to be breast fed for 9 months (and this is the object to be aimed at) weaning will begin at eight months, and great changes during the weaning period should be avoided. If baby is already taking enough different solid foods in reasonable amounts, so that meals can be made up by eight months, weaning will be easier and smoother; the infant will be receiving a good mixed diet, including most of the essential nutrients, and feeding difficulties will be less likely to arise during both the weaning period and the toddler stage. Progress too should be almost uninterrupted.

In order to be increased to reasonable amounts, the individual solid foods must be started much earlier—say at approximately six months of age, although this is merely an arbitrary guiding line. Some babies may with advantage be started on soft solids before six months, while it may suit others if the introduction of mixed feeding is delayed a little longer. Each baby must be judged on its own merits, abilities and tastes.

Patience is Essential.

Now for a few helpful hints on the subject. *Be Patient*—It is all something of a surprise to baby, so do not be discouraged by early refusals. He may not dislike the new food: he just wonders about it and rejects it till he can decide for himself. You should not react emotionally to the refusal; you may firmly insist that one mouthful be accepted or you may postpone the attempt for a few days and try again.

Never *force* baby to take anything, for fights over food can in no way contribute to the feeling of well-being and the establishment of a normal appetite, which are two of the specific objects of any feeding programme.

Be Gradual—Allow him time to get used to one novelty before he starts on another.

Variety is Desirable.

Be Varied—in what you offer. A number of our own prejudices are due to the articles of food not having been introduced to our diet earlier or else having been abandoned after a first unsuccessful attempt. So are many of the feeding difficulties encountered in young toddlers. The more catholic the taste, the better. It is usual to start the mixed feeding programme with a cereal such as Farex, Oat Jelly, Groats, etc. and then to go on to bone and vegetable broth, sieved fresh vegetables (Nestle's pureed vegetables are also recommended), egg yolk and egg custards, milk puddings (such as ground rice, semolina, sago, cream of wheat, junkets, etc.), cheese, the pulp of baked or stewed apple or apple sauce, or mashed ripe banana. A rusk or baked crust may be given from the time baby gets his first teeth, but remember, never leave him alone with a rusk in case he chokes. Butter and vegetable extracts may be added to the rusk. Then steamed fish, liver and meat may be added to the diet a little later.

Milk, of course, is also an essential part of the diet and by nine months of age, if not earlier, baby should be able to tolerate whole cow's milk. However, it may be wise to start with a diluted milk mixture first of all—say two parts of milk to one of water and then increase the strength of the mixture fairly rapidly until whole cow's milk is being taken. Where cow's milk cannot be obtained dried powdered milks may be used.

If persevered with, babies like almost anything that is good for them. They will not want the things that are bad for them, if they have never tasted them. Do not let them get the taste for cakes or sweets, although a piece of plain or milk chocolate or a wholesome sweet after dinner is allowable. And do not add too much sugar to baby's food. It is bad for the teeth and the digestion.

Make Food Attractive—in itself and in the manner of serving. Don't give too large helpings. You won't go far wrong if you feed your infant according to its appetite, and a second helping can always be added if necessary. Remember, children's appetites vary as much as adult appetites.

When to Wean.

Choose the Time of Year—If baby is ill, and during very hot weather, it is better to postpone weaning, as he may be fretful, less likely to co-operate and more likely to be upset.

Choose the Time of Day—to start innovations. Morning and mid-day novelties are less likely to upset than those introduced for the first time in the evening. Weaning schedules vary to some extent, but the general principles are the same. One breast feed is usually omitted each week until baby is completely off the breast, the first omission usually being at the 10 a.m. or 2 p.m. feed, when a dish of cereals or sieved vegetables and a glass of milk are substituted. The first and last breast feeds of the day are omitted last; the 10 p.m. feed may even be continued until baby is ten or eleven months old, according to circumstances.

How to Feed.

Liquids—Feed from a spoon or allow baby to feed himself from a cup as soon as he shows any aptitude for this. Bottle feeding should be discontinued from the age of nine months, if not before. It is a slovenly and lazy habit to let baby continue with bottle feeding when he is quite capable of drinking from a cup.

Solids—Whenever possible, allow baby to attempt to feed himself—the fingers will be used at first. The child learns its table manners from the example of its parents, but it must be allowed to be messy during its second year. The aim is to encourage it to feed itself as soon as possible, a feat only to be learnt by trial and error, and feeding difficulties sometimes arise either because the child is entirely fed for too long, or if made to feed itself, is expected to do it neatly at too young an age.

And Remember—A child's appetite is usually a good guide to his needs.

The following moral could with advantage be carved on many a nursery mantel-piece.

The food your baby does not eat never does him any harm.

Any further information on this and other matters connected with children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's Terrace, Brisbane, or by addressing letters "Baby Clinic, Brisbane." These letters need not be stamped.

JUNIOR FARMER CLUB ACTIVITIES.

Junior Farmer clubs formed recently in North Queensland are making good headway, and reports received from all sources show a decided increase in both membership and activities.

The clubs at Mossman, Goondi (near Innisfail), Sarina, Bowen, Malanda, and Kairi had representatives for the first time at the Brisbane show as guests of the R.N.A. at a special "camp" arranged for their benefit on the showgrounds. They comprised George Quaid, Geoff. Dodds, Robert McKie, Keith Maclean, Ron. Duffy, and John Penigas respectively.

At the recent Atherton show, the Malanda and Kairi-Danbulla clubs each staged an exhibit, the former winning by the narrow margin of six points. As a result, the club's library fund at Malanda will benefit to the extent of £13. Club secretary Don Drury is proving a real live wire since his return from Brisbane last March, when he took part in the Australian Broadcasting Commission's annual "leadership" contest to select Queensland's champion junior farmer boy for 1950.

Sarina and Bowen clubs, two of the newest clubs formed recently in North Queensland by the State Director (Mr. T. L. Williams), are displaying much keenness and an increase in membership numbers and club activities. Eton North, where until recently there existed a Junior Canefarmers' Society, is now being numbered among the most active and progressive in the State. Recently, two of its members were invited to give evidence at the sittings of the Royal Commission enquiring into the sugar industry in Queensland, while a number of local bodies have included members of the club on their committees of management.

The club at Eungella (Dalrymple Heights) is also making headway and is strongly supported by members of the local branch of the Q.D.O. and interested farmers.

ASTRONOMICAL DATA FOR QUEENSLAND.

NOVEMBER.

Supplied by W. J. Newell, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4.59	6.05	Cairns	46	11	Longreach	43	28
6	4.55	6.09	Charleville ..	29	25	Quilpie	33	37
11	4.52	6.12	Cloncurry	62	38	Rockhampton ..	18	2
16	4.50	6.16	Cunnamulla ..	28	31	Roma	18	15
21	4.48	6.20	Dirranbandi ..	17	21	Townsville ..	38	11
26	4.47	6.24	Emerald	26	13	Winton	50	31
30	4.46	6.27	Hughenden ..	47	23	Warwick	3	6

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	11.45	9.11
2	..	10.08
	a.m.	
3	12.26	11.08
		p.m.
4	1.04	12.08
5	1.38	1.08
6	2·11	2.08
7	2.43	3.11
8	3.16	4.17
9	3.53	5.26
10	4.34	6.39
11	5.23	7.53
12	6.20	9.05
13	7.23	10.09
14	8.31	11.04
15	9.39	11.50
16	10.45	..
		a.m.
17	11.46	12·28
	p.m.	
18	12.44	1.02
19	1.39	1.31
20	2.33	1·59
21	3.26	2.27
22	4.21	2.56
23	5.16	3.27
24	6.12	4.01
25	7.08	4·40
26	8.03	5.23
27	8.55	6.12
28	9.42	7.05
29	10.24	8·02
30	11.02	9.00

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19; Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	10	30	25	45	0	21	27	54
6	16	20	31	37	7	11	36	42
11	29	9	44	24	19	0	52	26
16	26	13	43	29	18	3	50	32
21	15	22	31	38	6	13	35	43
26	9	30	25	45	0	21	26	54
30	12	28	27	43	2	19	30	52

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	5	56	35	67	19	53	5	46
3	8	52	36	65	21	50	8	44
5	18	38	42	57	27	42	16	33
7	29	26	50	47	35	33	25	22
9	41	13	57	39	42	24	34	13
11	52	3	66	32	50	18	43	4
13	57	2	69	32	53	17	47	3
15	52	9	66	36	50	22	43	9
17	42	14	58	40	43	25	35	14
19	31	25	51	47	35	32	25	22
21	20	35	44	55	29	40	18	30
23	11	45	38	60	23	46	10	37
25	3	52	34	65	18	50	4	44
27	2	56	33	67	17	53	3	46
29	7	53	36	66	20	51	7	44
30	11	50	38	63	23	49	10	42

Phases of the Moon.—Last Quarter, 3rd November, 11 a.m.; New Moon, 10th November, 9.25 a.m.; First Quarter, 17th November, 1.06 a.m.; Full Moon, 25th November, 1.14 a.m.

On 15th November the Sun will rise and set 20 degrees south of true east and true west respectively, and on the 7th and 20th the Moon will rise and set very close to the respective true east and true west points.

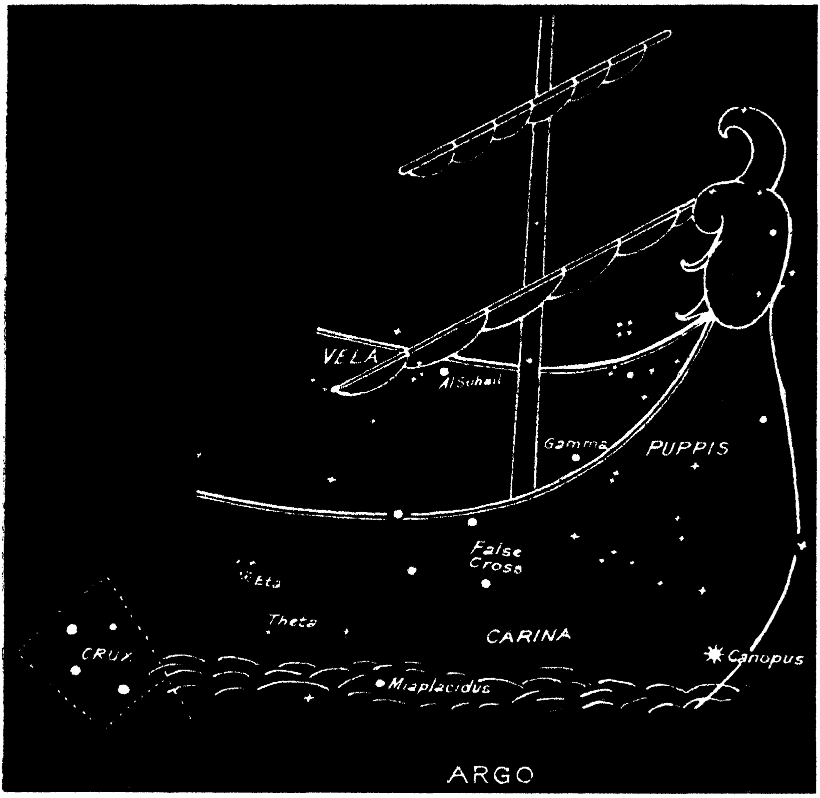
Mercury.—An evening object all this month. On the 1st, in the constellation of Libra, there will be only a few minutes difference between its setting and sunset, but by the end of the month, in the constellation of Ophinchus, it will set 1½ hours after the Sun.

Venus.—In line with the sun on the 13th and so not visible during this month.

Mars.—In the constellation of Sagittaruis, at the beginning of the month, will set between 9.50 p.m. and 11 p.m., while at the end of the month it will set between 9.30 p.m. and 10.30 p.m.

Jupiter.—Also an evening object, being situated in the constellation of Aquarius and about overhead at nightfall. At the beginning of November it will set about 2 hours after midnight, but by the 30th will set just before midnight.

Saturn.—In the constellation of Virgo, is now observable low in the east during morning twilight. On the 1st it will rise nearly 2 hours before the Sun and at the end of the month will rise soon after midnight.



CONSTELLATIONS.

ARGO.

This is the largest constellation in the heavens, covering approximately 75° of arc, and is situated between declination 10 degrees south and 75 degrees south. Like most other constellations it bears little resemblance to the object it represents, the ship Argo. The reasons advanced for the name are varied. One story is that it was named after the ship built by Argo for Pelias, King of Iolcus, to carry Jason and his comrades, including Castor and Pollux, Hercules, Orpheus and Meliager, to Aea in Colchis to search for the Golden Fleece. When the voyage was over the goddess Athene placed the ship in the sky. Another legend says it was named for the first ship to sail the ocean—the ship which long before Jason's time carried Danaos and his fifty daughters from Egypt to Argus and Rhodes. Yet another legend says that it was the ark which carried Isis and Osiris across the deluge. The constellation as a whole contains some 800 odd lucid stars and for convenience modern star atlases divide it into various parts—Carina the Keel, Puppis the poop or stern, and Vela the sail—but the original sequence of letters and numbers has been retained so that we now often find Canopus referred to both as Alpha Argus and Alpha Carinae, or Eta as both Eta Argus and Eta Carinae, these stars being situated in Carina or the Keel. Old records do not show more than half a ship, the bow being missing.

Covering such a large area of the sky and being placed in the region of the Milky Way, it is natural that this constellation will contain many interesting objects both for naked eye observation and with optical aid. The brightest star of the group, Canopus, is the second brightest star in the heavens. It is a yellowish-white giant, many times larger than our sun, and has a surface temperature of 7,500°C., while its brightness is about 100,000 times that of our sun and its distance 650 light years. Argo also contains that group often mistaken for the Southern Cross and known as the false Cross. It lies about midway between Crux and Canopus, its relation to Crux being shown in last month's journal. Gamma Velorum, which to the naked eye appears as a single star, under magnification resolves into a group in the shape of an aeroplane. About half way between the Southern Cross and false Cross is the famous Keyhole Nebula, the dark patch in the centre being very much like a keyhole. On the edge of this Nebula is the noble star Eta. In 1677, Halley observed this star as of 4th magnitude. It oscillated between that value and 2nd magnitude until 1814, when it began to brighten, reaching 1st magnitude in 1827. It fell to 2nd magnitude for about 5 years and then rose to 0 magnitude in 1838, outshining Regel (Beta Orionis). It faded somewhat and then in 1834 rose to minus 1 magnitude (about as bright as Canopus). Thereafter it declined till it became invisible to the naked eye about 1867. It reached 7th magnitude in 1870 and has not altered much since.

The star Theta is known as the Southern Pleiades, several stars being grouped round a prominent star as in the Pleiades in Taurus.

The constellation rises in the south-east soon after sunset in November and is visible almost the whole night from November to February. In April it is "overhead" about 7 p.m. and from Queensland at any time of the year it is below the horizon for about only 5 or 6 hours during the day.

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9

Contents

Queensland Certified Hybrid Maize.

Part 2. Notes for Growers on Procedure of Seed Production.

W. W. BRYAN, formerly Plant Breeder, Queensland Agricultural High School and College, Lawes.

IN Queensland, seed certification is under the control of the Seed Certification Committee, which is appointed by the Minister for Agriculture and Stock. This committee is advised by a Hybrid Maize Seed Certification Sub-committee of four members, also appointed by the Minister. Seed Certification Officers submit their reports to the Sub-committee and final decisions are returned by the Committee to the field officer and through him to the grower.

The objects of certification of hybrid maize seed are to—

(1) Give the purchaser reasonable assurance that the specific hybrid is approved on the basis of official and impartial performance tests, that the seed is true to label, and that it is in satisfactory condition for planting.

(2) Give the seed grower recognition and recommendation for hybrid seed properly produced.

(3) Provide unbiassed inspection of the technical operations of seed production, and assist in developing orderly and reliable methods of increasing hybrid maize seed.

The production of certified commercial hybrid maize seed—which is the final product—is achieved by firstly breeding inbred maize, then foundation hybrid maize, and finally certified commercial hybrid maize.

"Inbred maize" is produced by the Plant Breeder at the Agricultural College at Lawes only for use at that institution in the production of "foundation hybrid maize." The latter (foundation hybrid seed) is supplied by the Seed Certification Committee (through its agent, the Plant Breeder, Queensland Agricultural College, Lawes) to growers with registered areas for the production of certified commercial hybrid maize seed.

The essential features of certified commercial hybrid maize seed production by farmers are:—

(1) A probationary training period for seed growers.
(2) Registration of an area to produce certified seed.
(3) Proper isolation.
(4) Thorough detasselling.
(5) Correct and careful harvesting and shelling.
(6) Inspection and final sealing of shelled certified commercial hybrid seed.

PROBATIONARY TRAINING.

Before a grower can undertake seed production, he must serve a probationary training period of one season in order to learn the method of procedure. Essentially this consists of growing a small (¼ acre) crossing plot, for the conduct of which he is given all necessary advice and assistance by a fully trained seed certification officer. The seed grown on a probationary plot is to be used *only* by the grower and is on no account to be sold or even given away. It will not be certified.

Having succeeded in his probationary period, the grower is free *either* to engage in the commercial production of certified seed for his own use and for sale (under certification) and is known as a "Commercial Producer," *or* to produce only his own seed requirements (without certification), when he is known as a "Home Producer."

REGISTRATION OF AREA AND PLANTING.

Any grower who desires to grow certified hybrid maize should contact the nearest Adviser in Agriculture or the Plant Breeder, Queensland Agricultural College, Lawes, who will supply an application form (Form A.1.) and information as to the procedure.

The area to be planted shall conform to the isolation requirements, shall be free of all volunteer maize plants, and shall not have been planted to maize for at least one year prior to sowing the crossing plot.

After the application form has been completed by the grower, an inspection will be made and a report forwarded to the Standards Officer, Department of Agriculture and Stock, Brisbane.

When an application is approved by the Committee the seed necessary to sow the area will be supplied by the Plant Breeder.

PLANTING THE PLOT.

The two parental crossing stocks supplied will be designated "pollen" (male or tassel) parent and "ear" (female) parent. At least two pollen rows must be grown on each side of the crossing plot. Pollen parents must be sown in separate rows from ear parents and all pollen rows clearly marked by pegs at both ends of the field. A handful of cowpea or sunflower seeds to every few pounds of pollen parent seed also serves to aid in identification of the pollen rows. It should be noted that as the seed supplied for crossing plots will have come from inbred line parents, this seed will be small and irregular in shape. Five pounds of this seed covers the same planting area as 8 lb. of normal sized seed.

The recommended ratio of pollen rows to ear rows is 1 : 3 and probably the easiest plan to follow in planting is to plant

Parent:	P.	E.	P.	E.	P.	E.	P.	E.	and so on.
(P = pollen, E = ear.)									
No. of rows:	2	2	1	4	1	2	1	4	and so on.

The 1 : 2 : 1 : 4 ratio is convenient to plant with either a 2- or 4-row planter. Fields that are more or less square, rather than long and narrow, ensure thorough crossing and proper pollination; the apprentice-grower plot is preferably planted therefore with rows not longer than 2½ to 3 chains.

PLANTING PLAN.

The method of planting a 20-row crossing plot with a 2-row maize planter is illustrated hereunder; arrows indicate direction of travel of the planter.

(*a*) Two pollen rows (P) are to be planted both before row 1 and after the last numbered row.

(*b*) When commencing to plant rows 1 and 2, the left-hand box of the planter must contain pollen seed, the right-hand box, ear seed. Then proceed as shown in the diagram.

	Row.	Type of Seed.	
	P	Pollen	
	P	Pollen	
Round 1: Pollen seed in left-hand box; ear seed in right-hand box.	1	Pollen	
	2		Ear
	3		Ear
	4	Pollen	
Round 2: Change left-hand box to ear seed.	5		Ear
	6		Ear
	7		Ear
	8		Ear
Round 3: Change left-hand box to pollen seed.	9	Pollen	
	10		Ear
	11		Ear
	12	Pollen	
Round 4: Change left-hand box to ear seed.	13		Ear
	14		Ear
	15		Ear
	16		Ear
	P	Pollen	
	P	Pollen	

Alternatively, and for larger areas, the following plan is also satisfactory and lends itself well to ease of harvesting. It is designed for a 4-row planter, but can also be planted easily with a 2-row planter.

The plan is:—

P. E. P. E. P. E. P. and so on.
2 6 2 6 2 6 2 and so on.

For a 4-row planter this works as follows, no changing of seed in boxes being necessary.

P P	P E E E	E E E P	P E E E	E E E P	P and so on
	Round 1		Round 2		Round 3

Upon completion of planting the grower must notify the nearest seed certification officer of date of planting and furnish a plan showing exact location and arrangement of pollen and ear rows. Form 2 is provided for this purpose.

ISOLATION.

No maize (other than the pollen parent) may be planted within 20 chains of the crossing plot, unless sown sufficiently earlier or later than the crossing plot to ensure that no pollen is produced by it while receptive silks are still present on the ear parent plants of the crossing plot.

Care must be taken to eliminate all volunteer maize plants within the area of isolation. This may involve some co-operation with neighbours.

Advance notification of flowering date is to be sent to the nearest seed certification officer on the form provided (Card M.163) not more than one week before the first tassels are expected to appear. Do not try to make an estimate of flowering too soon. Wait until a fairly safe estimate can be given. A few days' notice is all that is required.

DETASSELLING.

In detasselling, *all* tassels of the ear parent, both on main plants and on all suckers, must be removed *daily* before they begin to shed pollen. *The detasselling involves holidays as well as week-days, wet or showery days as well as fine days. This precaution, added to proper isolation, is absolutely vital to successful seed production.* Tassels are jerked out by hand. Every effort should be made to avoid pulling any leaves, as each leaf removed may lower yield by approximately 3 per cent. One man can handle about 2½ acres of detasselling. Great care must be taken to watch for late tassels on suckers. Always make a couple of inspections at intervals of 3-4 days after it is considered that detasselling is completed. The main detasselling activity occupies a couple of weeks only, but the bulk of the work usually occurs in a sharp peak of flowering covering only a few days about the middle of this period.

HARVESTING.

The required procedure at harvesting is as follows:—

(1) Either—

(*a*) All ears from the ear rows must be harvested first and all ears from the pollen rows and stray ears are to be left in the field until the field has been inspected to ensure that this procedure has been correctly carried out;

or—

(*b*) At the discretion of the seed certification officer, all ears from the pollen rows and stray ears may be harvested first and isolated in accordance with the directions of the seed certification officer, so that all possibility of mixing shall be eliminated. The field is then inspected before the ears from ear rows may be harvested.

(2) The ears from the ear rows are to be culled so as to ensure that all kernels affected by dry rot or other diseases or by ear worm, weevil and other insects are rejected. Removal of butts and tips, unless damaged, is not imperative. Any off-type ears or ears from off-type plants should also be discarded.

(3) When culling is completed and the grower is ready to shell, notification of readiness to shell (Card M.164) is forwarded to the nearest seed certification officer. This officer will inspect the bulk of ears from the ear rows and also the sheller, and then allow shelling to commence. The bags of seed are sealed as they come from the sheller.

The seed from pollen rows and stray ears shall be used or sold as *feed grain only*, but not for sowing.

After shelling, store under conditions to protect adequately from rodents, insects, damp or other damaging influences. Information on protection of grain can be obtained from the Department of Agriculture and Stock, or the Queensland Agricultural College, Lawes.

Samples of seed offered for sale will be forwarded by the seed certification officer:—

(1) For purity and germination test, to the Seed Testing Station, Department of Agriculture and Stock, Brisbane, and

(2) For field trial to the Plant Breeder, Queensland Agricultural College; a 12-ear sample of each parent is also sent to the Plant Breeder for a check on identification.

SEALING.

As shelled, the bags will be sealed with an official seal, and marked with a temporary label. If germination, purity and type are satisfactory a certification label giving full details will later be supplied for each bag and sealed to it by a seed certification officer. Seed will be sealed in either ½ bushel, 1 bushel, or 3 bushel lots. The seed is available for sale only after final labelling and sealing, and until final labelling cannot be removed from the premises without permission of a seed certification officer.

The area for seed production, isolation, detasselling and the final seed product are all subject to inspection and approval by a seed certification officer, whose duty it is to carry out the objects of certification in an impartial manner.

No hybrid maize seed may be sold in Queensland unless it is certified. This is to protect the public from possible exploitation.

The only official charge involved in the production of certified commercial hybrid maize seed is the cost of foundation hybrid seed for sowing the crossing plot. At present there is no charge for the certification service.

Certified commercial hybrid maize seed is produced only on registered areas, and sold in unopened sealed containers, duly labelled, to any purchaser for the production of feed or grain.

Seed for sowing should not be harvested from the subsequent crop, as reduction in yield will result.

The sale or offering for sale of any hybrid maize seed as certified seed unless in *sealed, labelled and unopened* containers is an offence under the *Seeds Acts* and renders the seller liable to a penalty of £50.

VEGETABLE PRODUCTION

Cucumbers, Rockmelons and Related Crops.

A. A. ROSS, Horticulturist.

THE vine crops of the cucurbit family most commonly grown commercially in Queensland are cucumber, rockmelon, pumpkin, squash, watermelon and choko. Other members of this family, such as gramma, gherkin and gourds, are planted only on a small scale. Most are tender annuals which are grown for their fruit. They require hot weather for their development and will not tolerate frost. Some are susceptible to leaf diseases, especially powdery and downy mildews during wet weather.

CUCUMBER AND ROCKMELON.

The cucumber is probably a native of Asia and Africa, and has been in cultivation for at least 3,000 years. The rockmelon also originated in Asia. These plants are closely related and in many respects the systems of culture of the two crops are similar.

Soils.

Where earliness is required, light textured soils such as sandy loams should be selected for the crop. However, cucumbers and rockmelons also grow well on heavier soils and high quality fruit is produced on loams and clay loams for an extended cropping period. Good drainage is essential, and provided this is satisfactory, soils 12 inches or more in depth can be expected to yield good crops.

Planting.

In the past, it was customary to plant cucumbers and rockmelons in "hills," that is, in groups of three or four plants spaced at distances of about six feet. The usual practice at the present time, especially where planting is done with a machine, is to sow the seed in drills from 4 ft. 6 in. to 6 ft. apart with about 12 in. between the plants. Later on the plants are thinned at the same time as the first chipping and spaced at approximately two feet. When planted in this way, about 3 lb. of seed will be required per acre.

Early crops are planted in late winter and spring according to prevailing temperatures in the district where they are grown. Young plants are easily damaged by frost but prices for early fruit are usually lucrative and growers are frequently prepared to risk winter planting in locations where frosts are normally light. In some districts

growers make two or three successive plantings at approximately weekly intervals so that even if the first is destroyed by frost, seedlings from the later sowings will escape injury. The best plants are then selected, the others being chipped out.

Fertilizers and Manures.

On all soils which are intensively farmed the regular addition of organic matter is essential. Where it is available, applications of farmyard manure are highly desirable. An annual green manure crop such as Poona pea which is turned into the soil when it matures is perhaps the best practical substitute for farmyard manure.

A complete fertilizer mixture containing nitrogen, phosphoric acid and potash, with an analysis of approximately 5 : 13 : 5, and applied at the rate of 10 cwt. per acre prior to sowing the seed, is recommended. This may be applied broadcast and worked into the soil during the later stages of land preparation for the crop. However, a better practice is to place the fertilizer in the drill beneath the seed. This can be achieved by opening a furrow with a mouldboard plough, distributing the fertilizer on the walls and bottom of the furrow at the rate of eight to ten pounds per chain, and finally covering in the furrow with a scuffler, which leaves a mark to indicate the position of the fertilizer row when the seed is planted.

A topdressing is usually required, especially in the lighter soils, at the time the vines have run about a foot. Either sulphate of ammonia at the rate of 1 oz. per plant (2 cwt. per acre) or, if the soil is fairly well supplied with nitrogen but is low in other plant foods, a complete fertilizer with an analysis of 10:6:10 or 10:8:7·5 at the rate of 1½ oz. per plant, would be suitable for this purpose.

Plate 184.

Young Cucumber Crop.—The pines protect seedlings from wind and are removed when the cucumbers start to run.

Cultivation.

Cucumbers and rockmelon crops must be well worked early in the growing period, for once the vines start to run (Plate 184), they cover the ground quickly and machine cultivation becomes impossible. Inter-row cultivation can be performed by power implements but inter-plant cultivation must be done by hand hoe. Cultivation should be shallow and just deep enough to destroy weeds, otherwise root injury due to deep cultivation may give the crop a setback.

Irrigation.

All cucurbit crops need an ample supply of water, especially in the early stages of growth. However, with cucumbers and rockmelons a complicating factor to irrigation late in the season is their susceptibility to powdery and downy mildews. Over-watering, especially with overhead sprinklers, after the plants have met in the row tends to encourage these diseases. The object, then, is to apply water fairly frequently until the plants meet in the rows, and thereafter restrict irrigation to an early morning application when the crop shows symptoms of stress.

Harvesting.

When grown under good conditions, cucumber crops are ready for harvesting about 12 weeks after planting. The fruit should be picked while it is still green in colour and the seeds are soft. Fully mature, yellowish fruit is unsaleable. Fruit is picked into tins or baskets and packed into cases, usually of half or one bushel capacity.

The correct stage for picking rockmelons depends on variety, climatic conditions and distance from market. To develop its best flavour, a rockmelon must be left on the vine as late as possible, yet it must be marketed before it becomes soft. There is no definite external indication of approaching maturity, but with practice certain changes can be recognised in the netted varieties. The netting becomes more rounded and the colour showing through the netting gradually changes from dark-green to yellow. When the fruit is fully ripe, an abscission layer develops at the junction of the stem and fruit; this is known as the "full-slip" stage, for the fruit is then easily removed.

Varieties.

The most popular varieties of cucumber are Early Fortune and Kirby's Stay-green. Crystal Apple is a small fruited, pale coloured variety which at times meets a reasonable market demand.

The netted varieties of rockmelons are popular with Australian consumers, and for ease of handling and packing the small round types are preferred. Hales Best and Rocky Ford are the most commonly grown, and when mildew-resistant strains are available they should be used. Other varieties such as Californian Cream, Yellow Cantaloupe, Yates Surprise and Honey Dew are good quality melons, but their large size and unnetted character lower their market value.

WATERMELON.

The watermelon (Plate 185) is probably of American origin and was not well known prior to the sixteenth century.

Soils.

The watermelon will not tolerate poor drainage and prefers a light soil such as a sandy loam. An open structured soil to which organic matter has been added in the form of farmyard manure or green manure crops is therefore desirable.

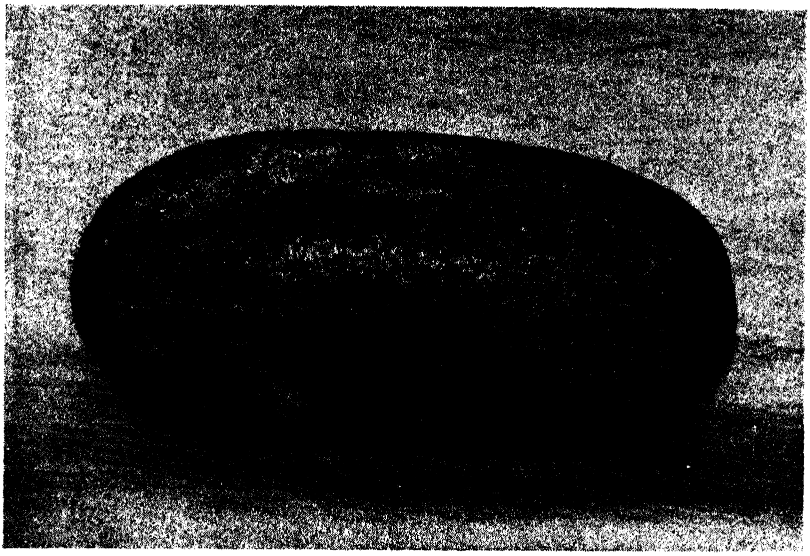


Plate 185.
Watermelon of the Variety Hawkesbury Wilt Resistant.

Planting.

Watermelons are usually established in "hills," which allow the field to be machine cultivated both ways. Spacings vary from 8 feet by 8 feet to 12 feet by 12 feet, the best results generally being obtained with the wider spacing. Several seeds are sown in each hill and the resultant plants are thinned to two or three. About 3 lb. of seed are required per acre.

Planting must be delayed until spring, when the frost risk has passed. The watermelon is slightly less tolerant to frost than the cucumber and requires a longer growing season. Very early crops can therefore be grown only in warm sheltered situations.

Fertilizers and Manures.

Where available, farmyard manure should be placed in and near the "hill" positions. Prior to planting, a basal application of a fertilizer with a composition of approximately 5 : 13 : 5 at the rate of 6-8 cwt. per acre is advisable. In most cases the crop would benefit from topdressing with a 10 :6 :10 or 10:8 :7·5 mixture at the rate of 2 oz. per "hill" when the plants have run about 18 inches.

Cultivation.

Until the plants meet, cultivation should be frequent, thorough and just deep enough to destroy weeds.

Irrigation.

Watermelons are not as subject to leaf diseases as cucumbers and rockmelons and the irrigation programme need therefore not be so precise. The crop should be given a plentiful supply of water up to the time the melons are about three-quarters grown, after which irrigation is required only when the first signs of wilting are seen.

Harvesting.

It is difficult to pick a mature watermelon from external characters, as the skin colour does not change with advancing maturity and size gives no indication of ripeness. Experienced growers tap the fruit with the knuckles and listen for the "hollow" sound. This varies with the variety and it is therefore a wise precaution to cut a few melons after tapping to determine the significance of the sound as a test of maturity, and harvest accordingly. The fruit should be picked with a stem of about two inches attached in order to reduce injury from stem end rot. They are loaded singly into wagons and packed up to four layers deep. Watermelons are usually delivered to market in the grower's own vehicle.

Varieties.

The present trend is to plant a variety which exhibits some wilt resistance, for in many fields this disease has become very serious in recent years. Hawkesbury Wilt Resistant and Sugarstick Wilt Resistant are good quality melons with a crisp, bright-red flesh and a relatively thin rind There are numerous varieties of watermelons available, but in addition to the wilt resistant strains, Kleckley Sweet, Tom Watson, Coles Early and Market Wonder are the most popular with commercial growers.

PUMPKIN, MARROW, AND SQUASH.

A great deal of confusion exists in the classification of these cucurbit crops, but they fall into three groups—pumpkins (Plates 186 and 187), marrows and squashes (Plate 188), and bugles, grammas and cushaws, which are better known in North Queensland than in other parts of the State.

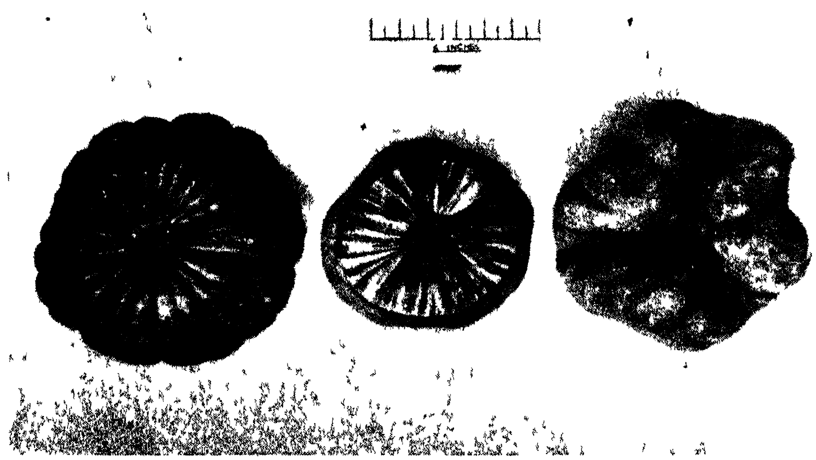


Plate 186.

Pumpkins of the Turban Group.—Left to right—Queensland Blue, Turk's Head and Triamble.

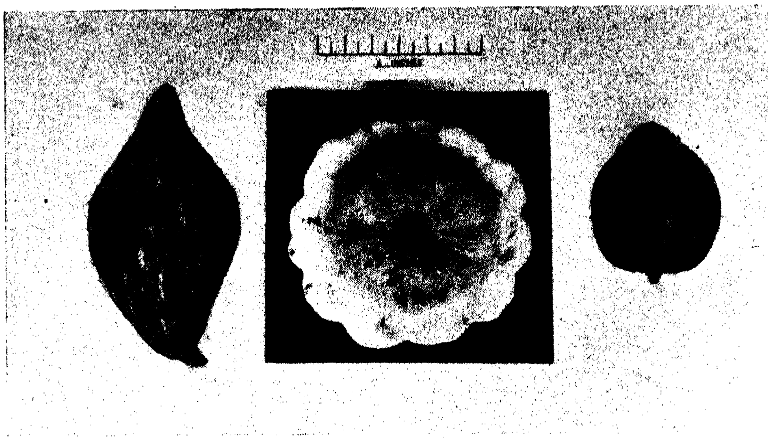


Plate 187.
Squashes.—Hubbard, White Custard and Table Queen.

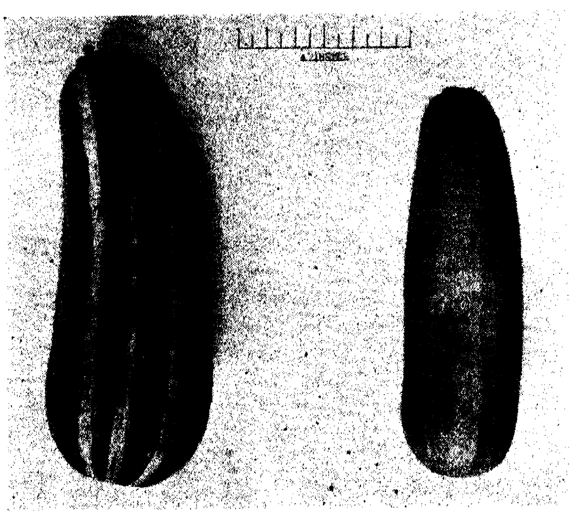


Plate 188.
Marrows.—Yellow Striped and Long Cream Bush.

Soils.

Pumpkins and related crops may be grown successfully on a wide range of soil types and generally do well on heavier soils than those best suited to watermelons and rockmelons. Excellent crops of pumpkins are produced, for example, on the black clay loams of the Lockyer Valley and the Darling Downs. However, they thrive best in well drained soils which are rich in organic matter.

Planting.

All these crops are subject to frost damage, and planting, except in frost-free districts, must be delayed until the spring when the risk of injury is slight. Planting usually extends from September to the end of December.

Pumpkins are usually planted in drills 10 to 12 feet apart, seed being dropped singly at intervals of 3-4 feet. Planting in "hills" is also satisfactory, two or three seeds being planted in groups at 6-8 feet spacings. Squashes and marrows, which produce smaller plants, are sown more closely, drills being spaced 4-5 feet, with plants 2 feet apart. Approximately 2 lb. of seed is sufficient to plant an acre of pumpkins and 4-5 lb. for those species which are planted more closely. At times, heavier sowings are made, to allow for seed or seedling losses caused by insect and other pests, any surplus plants being thinned out later.

Fertilizers and Manures.

It is the usual practice to grow pumpkins, marrows and squashes after a crop which has been heavily fertilized, the residue meeting the nutritional requirements of the cucurbit. However, on light soils fertilizer applications may be necessary. A pre-planting application of 6-8 cwt. per acre of a complete mixture with an analysis of about 5:13:5 should prove satisfactory. Except in very fertile heavy soils it is advantageous to topdress the crop with a complete fertilizer mixture of a 10:6:10 or 10:8:7·5 formula at the rate of 2 oz. per vine when the plant has run about 12 to 18 inches.

Cultivation.

Early cultivation should be frequent in order to get weeds under control before the plant spread prevents the use of machines. Hand chipping between plants is important in the early stages of growth. As with other cucurbit crops, cultivation should be shallow.

Irrigation.

The water requirements of these plants are high and lack of water at critical periods causes shedding of the partly formed fruit. In excessively wet seasons, mildews cause much damage to the leaves and water should therefore be used sparingly towards the onset of the normal period for summer rains.

Harvesting.

Crops of the pumpkin type are usually allowed to mature in the field, where they frequently remain until the vine dies or is frosted. A short length of stalk should be left attached when the fruit is picked to lessen the risk of stem end rot. Late crops store very well in a dry, cool building such as a well ventilated barn, but they should be kept either on racks or in a single layer, as wastage is apt to occur in heaped pumpkins.

The vegetable marrows and the scallops should be harvested before they are fully developed; if they are allowed to mature on the plant, the flesh becomes soft and the fruit loses flavour. Marrows are normally despatched loose to local markets and packed in sacks or 1½ bushel cases for more distant centres.

Varieties.

Within each of the three cultivated species in the genus Cucurbita, there are several distinct groups of varieties, clearly

distinguishable by fruit shape. Plants of the pumpkin type are divided into the following groups:—

(1) *Hubbard*.—Fruit oval in shape but always pointed at the blossom end. Surface varies from smooth to strongly warted. Colour ranges from deep green to orange. This group includes the varieties Golden Hubbard and Green Hubbard.

(2) *Turban*.—Fruits are turban shaped, usually with a button at the blossom end. The thick, hard shell gives a long storage life to varieties in this group. The varieties include the Queensland or Beaudesert Blue—a very popular table pumpkin—Triamble, Ideal, Ironbark and Crown. Unfortunately, strains of all these varieties are somewhat variable.

(3) *Mammoth*.—Huge fruit often used for stock food. They usually have large seed cavities and a coarse, pale soft flesh. Varieties include Mammoth Cattle, Mammoth Yellow and Mammoth Chili, but again strains are considerably mixed.

(4) *Banana*.—Somewhat similar to the hubbards in shape, but usually more elongate. They are generally greyish-green in colour but have a softer rind than the hubbards. They are reputed to be of excellent flavour but are not grown to any extent in Queensland. Chief varieties are Banana and Plymouth Rock.

Varietal groupings for the plants of the marrow and squash type include:—

(1) *Patty Pan*.—Flat fruits with scalloped edge, plants being of bushy habit. Varieties belonging to this group are:—Early White Bush Scallop, Early Yellow Bush Scallop and Golden Custard.

(2) *Vegetable Marrow*.—Oblong fruit with smooth hard rind ranging in colour from white to dark green. Plants are both bush and twining in habit. Varieties include Long White Bush, Long Creamy Marrow, Long Cream Bush and Zucchini.

(3) *Crookneck, Fordhook and Connecticut Field,* which are not grown commercially in Queensland, would not be expected to meet a ready demand on local markets.

CHOKO.

The choko (Plate 190) is a popular fruit on Queensland markets and differs somewhat from other cucurbit crops in that it is perennial in habit, contains only one seed per fruit and is usually grown on trellises or frames. It is reported to be a native of Mexico, Central America and the West Indies.

Soils.

Because of the perennial habit of the choko, it is wise to select a relatively deep, well drained soil, preferably with a sandy loam texture. The plant will also do well on heavier soils if good cultural practices are adopted.

Plate 189
Trellised Choko Bowers at Sunnybank.

Plate 190
Fruit of the Choko Variety, Cream.

Planting.

Before planting, substantial trellises (Plate 189) capable of standing for several years should be erected. These are usually constructed in the form of an arch about 6 feet high, 15 feet wide at the top and 22 feet wide at the bottom. Wires are stretched along the sides and top of the trellis at intervals of approximately 15 inches.

The entire choko fruit is used for planting, whole fruits being set at approximately 12 feet intervals along each side of the trellis. Planting usually takes place in the spring, but the time will be determined by the maturity of the seed. When the seed is mature, the fruit sends out a shoot at its basal end, and planting begins as soon as this shoot appears. The fruit is placed in the ground at an angle of about 45 degrees, with the shoot downwards and at a depth of 3-4 inches. The apical end of the fruit is then at ground level or slightly exposed.

Fertilizers and Manures.

Careful preparation of the soil should precede planting and all available farmyard manure should be applied to the approximate sites for the plants. Pre-planting applications of fertilizers may be necessary to provide a suitable medium for growth, especially in the lighter types of soils. The nature and rate of this application will depend to a certain extent on the previous cropping history of the soil, but the fertilizer used should contain a fairly high proportion of nitrogen.

Topdressings are an important means of supplying nutrients to the plant. Two topdressings should be made during the season, one in midsummer when the main crop is setting and the other in early spring just as the plant moves into growth after the winter dormancy. According to the type of soil, an 8:10:5·5, 5:13:5 or similar complete fertilizer mixture would be suitable for the spring dressing, 8-10 lb. per plant being applied. In midsummer, 2-3 lb. per plant of a 5:14:5 mixture should be used. The topdressing should be spread evenly around the plant over a circular area having a radius of approximately five feet.

Cultivation should be shallow, and frequent enough to keep weeds in control. In cold locations it may be necessary to protect the roots and base of the plant during winter. When growth has ceased in the winter, the vine may be cut back and the soil mulched to avoid frost damage. In the spring, the tuberous root will throw out new shoots and the vine will recommence cropping.

Irrigation.

Soil moisture must not be allowed to become deficient at any time during active growth, and as the plant has a high water requirement frequent irrigation is necessary.

Harvesting.

When the plant has become well established, two crops will be produced each season, a light crop in late spring and early summer and the main crop in autumn. A small number of fruit will also mature during the summer. Chokos should be harvested when fully developed yet should not be allowed to become old and seedy. They are frequently marketed loose for the local market, but for distant markets they should be packed in cases.

Varieties.

There are two varieties, the green and the cream. The green is the more popular type but the market requires reasonably large fruit free of spines. The cream variety is sometimes favoured by home gardeners.

PLANT PROTECTION

Brown Rot Control Experiments in the Stanthorpe District, 1948-49 and 1949-50.

W. PONT, Assistant Pathologist, Science Branch.

BROWN rot, caused by the fungus *Sclerotinia fructicola*, is a major cause of loss in stone fruits throughout Australia. At a conference of Australian plant pathologists held in 1949, it was agreed than an average loss in stone fruit production of 10-15 per cent. per annum due to this disease would be a conservative figure.

During recent years in Queensland, the 1947-48 and 1949-50 seasons have seen large scale market condemnations of stone fruit consignments due to brown rot infection. In this State heavy losses occur when rainfall during the late spring and summer is above average, but epidemic outbreaks of the disease do not seem to be dependent on this factor alone. In some seasons in which rainfall for the season as a whole has been above average, brown rot incidence has been slight. Heavy rains early in the season appear to play an important part in causing epidemics of the disease. For example, in both 1947 and 1949 October was characterised by abnormally high rainfall and number of wet days, while in 1948 the opposite was the case. It was observed in 1949 that the prolonged wet conditions in October caused a build-up of the fungus on apricots, which, due to their sensitivity to sulphur and copper compounds, receive no fungicidal treatment subsequent to a sulphur or copper application at petal fall. Once the material for infection was built up, the incidence of the disease fluctuated with rainfall and very severe losses occurred in fruit which experienced fairly consistent rain or overcast conditions immediately prior to harvest.

Incidence of brown rot in the case cannot be divorced from incidence in the orchard. Preventive measures must originate in the orchard and should consist of efficient orchard sanitation, to prevent overwintering of the fungus, plus the use of a spray programme designed to keep a protective cover of fungicide on the fruit throughout its development. The problem with brown rot is to obtain a fungicide which is toxic to the fungus spores but which is not toxic to the tree and which does not leave a noticeable residue on the fruit. This last point is important so long as a pre-harvest spray remains necessary.

Sulphur sprays of various types have been proved over a number of years, in countries where brown rot is a problem, to reduce the amount of infection. In Queensland, lime sulphur, because of considerations of cheapness, ease of preparation and proved toxicity to the brown rot fungus in the laboratory, has for some time been recommended as a preventive spray for brown rot control. In view of the losses from the disease which still occur, experiments were carried out during the seasons 1948-49 and 1949-50 to further test the efficiency of lime sulphur under orchard conditions in Queensland. In two of the experiments a second sulphur compound, a wettable sulphur, was included.

Experimental Procedure and Results.

During the 1948-49 season, experimental spraying was carried out on Goldmine nectarines at Glen Aplin. Forty-eight trees were included in the experiment. These were divided into four blocks of twelve trees each. Spray treatments used involved lime sulphur and a wettable sulphur each used in two schedules, thus giving four treatments. These treatments were applied separately to plots of two trees within each of the four blocks. For the purpose of gauging brown rot incidence within the experimental area, four trees were left unsprayed in each block. The two schedules mentioned above were a long and a short schedule respectively. The long schedule consisted of fortnightly spray applications commenced in mid-November and carried through to harvest. The short schedule consisted of similar fortnightly applications commenced in mid-December.

Lime sulphur was used at a strength of 1-80 during November, but because of the possibility of spray damage to the trees during the warmer months the strength was reduced to 1-120 in December and January. Agral 2 spreader was used with the lime sulphur at the rate recommended by the manufacturer. Wettable sulphur was used at a strength of 1 lb. to 20 gallons throughout.

This experiment was repeated in the 1949-50 season on the same trees. Treatment schedules and the amount of brown rot infected fruit in each for the respective seasons are given in Table 1.

Additional experiments were laid down in the 1949-50 season, one on plums and two on peaches. Forty trees were included in each experiment. These were divided into four blocks of ten trees each. Spray treatments consisted of lime sulphur used in long and short schedules and in two strengths as follows:—

(1) 1-80 in November; 1-100 in December and January;

(2) 1-100 in November; 1-120 in December and January.

In the trial with plums, in order to avoid burning, the second November application was reduced to 1 in 100 and 1 in 120 respectively.

Four spray treatments were thus involved. These treatments were applied separately to plots of two trees within each of the four blocks. One plot of two trees in each block was left unsprayed. Table 2 details the treatments and shows the amount of brown rot in each.

TABLE 1.

SPRAYING TRIALS WITH NECTARINES (GOLDMINE).

(Harvest Dates : 12th January, 1949 ; 7th January, 1950.)

Treatment.	Applications.				Infected Fruit.	
	Mid-Nov.	End-Nov	Mid-Dec.	End-Dec.	1948–49.	1949–50.
					Per cent.	Per cent.
A. Lime sulphur ..	1–80	1–80	1–120	1–120	1·2*	6·0*
B. Lime sulphur ..	..	..	1–120	1–120	10·0	26·5
C. Wettable sulphur	1-20	1–20	1–20	1–20	6·8	21·4
D. Wettable sulphur	..	..	1–20	1–20	8·7	10·3
E. No spray ..	..	..	..	..	13·4	42·5

* Significantly better than no spray.

The figures given for percentage infected fruit in the tables were obtained from plot samples harvested from the various experimental blocks, wrapped to prevent spread from fruit to fruit in the container and stored at room temperature. They were examined and picked over at intervals until the soft ripe stage and the figures therefore represent total loss rather than loss at time of marketing.

TABLE 2.

SPRAYING TRIALS WITH PLUM AND PEACH.

Treatment.	Number of Sprays.			Infected Fruit.		
	Pond's Seedling Plum. (Harvested 26-1-50.)	Late Crawford Peach. (Harvested 31-1-50.)	Golden Queen Peach. (Harvested 22-2-50.)	Pond's Seedling Plum.	Late Crawford Peach.	Golden Queen Peach.
				Per cent.	Per cent.	Per cent.
A. Long schedule, strong	6	6	7	10·6*	13·1	62·5
B. Short schedule, strong	4	4	5	16·7	18·6	55·6
C. Long schedule, weak	6	6	7	17·5	12·1	60·8
D. Short schedule, weak	4	4	5	19·0	12·3	72·0
E. No spray ..	..	..	..	26·5	29·7	67·0

* Significantly better than no spary.

Discussion.

In the 1948-49 and 1949-50 seasons' experiments on nectarines, worthwhile control of the disease was obtained with long schedule lime sulphur (Treatment A). The low percentage brown rot infection for Treatment D in the 1949-50 experiment should be disregarded, as black mould rot (*Rhizopus nigricans*) was particularly prevalent in plot samples of this treatment and masked the true incidence of brown rot.

In the experimental work on Pond's seedling plums, long schedule strong lime sulphur (Treatment A) gave a decrease in infection of approximately 60 per cent. in comparison with unsprayed (Treatment E). The other treatments were less effective.

The figures obtained from the spray experiments on peaches are variable and difficult to interpret. No statistically significant reductions in percentage infections were obtained with any of the treatments in either experiment. The fact that the final spray on the Golden Queen peaches was applied 13 days before harvest at a time when the weather was exceptionally wet may have influenced the severity of the disease in this experiment. The reduced effect of the November sprays in the plum and peach experiments may have been related to the younger age of the fruit of these varieties at the time as compared with nectarines.

Spray residue did not present any difficulties except in the case of plums, and even here it is thought that use of more powerful and more efficient spray equipment would have eliminated the trouble.

These experiments have shown that until a more suitable fungicide for brown rot control has been found, little change can be made in the recommendations for control of this disease.

Orchard sanitation should be a primary consideration and this should comprise end-of-season removal and destruction of mummified fruit, and elimination, by pruning, of infected laterals. The lime sulphur 1-15 or Bordeaux 6-4-40 spray usually applied at bud movement for the control of rust and peach leaf curl should be supplemented by a schedule corresponding to Treatment A in the experiments described above.

The pre-harvest spray is considered important, especially if weather conditions are favourable for brown rot. This spray should be applied as close as is possible to the date of harvest. If continuous rain is experienced preceding harvest, the grower should still attempt to apply a protective spray when the weather lifts and before the fruit is harvested.

Acknowledgments.

These experiments were located on the orchards of Messrs. Lyons Bros., I. Martin and N. A. Collins and Son, all of Glen Aplin, and Mr. S. J. McLucas, Severnlea. The assistance rendered by these orchardists is greatly appreciated.

INOCULATION OF LEGUME SEEDS.

★ ★

The Department of Agriculture and Stock supplies cultures of bacteria for the inoculation of seeds of legumes such as Poona pea, blue lupins, lucerne and clovers.

Seed inoculation is often necessary where the legume intended for planting has not previously been grown successfully, as it provides the plants with bacteria which are necessary for their full development.

Cultures are supplied free and post free. They are in bottles and have to be mixed with skim milk for sprinkling on the seed.

Order from the Under Secretary, Department of Agriculture and Stock, Brisbane, at least 10 days before sowing. State amount and type of seed to be treated.

Butter Defects—Their Causes And Prevention.

V. J. BRIMBLECOMBE and E. B. RICE, Division of Dairying.

BUTTER defects may be divided into three classes:—(1) Flavour and aroma defects; (2) body and texture defects; and (3) colour defects.

FLAVOUR AND AROMA DEFECTS.

The best quality Australian butter has a full, sweet, nutty flavour and a pronounced butter aroma. However, provided the butter has a clean, neutral fat flavour it is classed as choice grade. Any taint of weed, bacterial, chemical, or other origin is regarded as a defect which will cause the butter to be placed below choice grade, the actual grade assigned being dependent on the nature and intensity of the defect.

Flavour and aroma defects are mainly due to "off" flavours in the cream from which the butter was made, although they may become accentuated in the butter. However, some flavour defects are due to faulty factory practice, or conditions of holding. The Department's leaflet entitled "Cream Defects—Probable Causes and Prevention" should be consulted for fuller information on taints in cream which may be transmitted to the resultant butter.

(*a*) Flat Flavour.

The butter is flat and slightly insipid to the taste and devoid of a sweet nutty flavour and pleasant aroma. This is caused by the churning of cream from cows in poor condition, excessive dilution of the cream with water prior to churning, over-washing the butter in the churn, or neutralising cream to too low acidity.

Remedy. Avoid excessive use of dilution or wash waters and over-neutralisation of cream.

(*b*) Bitter Flavour.

This defect may be caused by a predominance of cream from cows advanced in lactation, contamination of the cream by certain yeasts, the use of unrefined salt, or the leakage of brine from the refrigeration system into the cream.

Remedy. Dry off cows for six weeks before freshening; an overhaul of shed methods is indicated on farms supplying yeasty cream; use a good refined salt; avoid brine leaks.

(*c*) Yeasty Flavour.

This is caused by cream produced under insanitary conditions and held at high temperatures.

The remedy is obvious.

(*d*) Sour Flavour and Aroma.

This defect may be caused by the churning of cream which has not been properly neutralised before pasteurisation, or contamination after pasteurisation. Overchurning of the cream yielding large butter granules is also suspected to favour sourness.

Remedy: See that neutralisation is carefully carried out; churn to the correct size grain (wheat size).

(*e*) Stale Flavour.

Stale flavour in butter is generally caused by stale cream, and is often noticed when cream deliveries are infrequent in winter months. Stale butter and cream remnants in improperly washed churns, vats, pipelines, &c., many be contributory causes.

Remedy. Clean methods of cream production and frequent deliveries to the factory, allied with factory hygiene.

(*f*) Unclean Flavour and Aroma.

This defect in butter is usually caused by cream of inferior quality. Blending of cream below choice grade with choice grade cream gives a slight unclean flavour to butter. Improper care of factory equipment and defective churns may also cause an unclean flavour.

Remedy. Clean dairy shed methods, proper cleaning and maintenance of factory equipment, and efficient grading of cream are indicated.

(*g*) Absorbed Flavour.

This may be due to absorbed flavours in cream, or storage of butter near odoriferous material.

The remedy is obvious.

(*h*) Oily, Metallic, and Tallowy Flavours.

These defects are dealt with collectively as the causes are similar, and they often (though not always) represent a sequence of flavour changes. The butter has a distinct taste and odour resembling oil, metals or tallow. Tallowy butter is usually bleached in colour. The defects are usually due to oxidation of the butterfat, which can be promoted by minute traces of copper and/or iron compounds derived from faulty cream cans or factory equipment. Direct sunlight shining on cream may cause tallowiness, the taint carrying through into the butter.

Remedy. See that factory equipment is well tinned or replaced by stainless steel equipment; re-tin or renew rusty cans, or cans from which any part of the tinning has worn; protect cream and butter from direct rays of the sun.

(*i*) Rancid Flavour.

This defect is due to decomposition of the fat and is characteristic of carelessly produced cream or very old butter. Certain fat-splitting bacteria, acidity, age and high temperatures are the causative agents.

Remedy. On any farm producing rancid cream a complete overhaul of farm hygiene is necessary. Efficiently pasteurise cream to destroy fat-splitting micro-organisms; maintain a high standard of factory hygiene; use low storage temperatures to prevent heating and breakdown of fat.

(*j*) **Cheesy Flavour.**

This defect, which is self-descriptive, is mainly caused by the manufacture of butter from cream produced under insanitary conditions and allowed to become sour and curdy or over-ripe.

Remedy. An overhaul of farm production methods is indicated.

(*k*) **Musty or Mouldy Flavour.**

Butter which becomes wet during transport or storage is likely to become mouldy. The fault may also be due to cream stored in a musty or mouldy place or cows eating musty or mouldy fodder.

(*l*) **Fishy Flavour.**

This defect was common in Australian butter some years ago before lower neutralisation was adopted. Factors favouring its development are high acidity, traces of metallic salts, salt and overworking. Fishy flavour rarely occurs in present-day, low-acid butter.

(*m*) **Feedy or Weedy Flavour.**

Taints in milk and cream caused by weeds or feeds eaten by the cows are carried through into the butter. The intensity of the defect is dependent on the stage of growth at which the tainting feed or weed is eaten, the amount consumed, the season of the year, and the manner in which the cows are grazed. Most feed taints (for example, lucerne) are removed from cream by modern vacuum pasteurisation, but some weed taints persist and, in fact, are intensified. The most common cream tainting weeds are lesser swine cress (*Coronopus didymus*), peppercress (*Lepidium* spp.) and turnip weed (*Rapistrum rugosum*).

Remedy. If practicable, where milk tainting plants are present, graze cows immediately after milking, taking them off such feed five to six hours before the next milking; avoid overstocking of farms and adopt good pasture management.

(*n*) **Cooked Flavour.**

This is a pronounced scorched flavour caused by excessive heating of the cream during pasteurisation, or keeping cream at a high temperature for a prolonged period. A slightly cooked flavour in butter usually disappears after the butter is held in cold storage.

Remedy. Avoid excessive exposure of cream to high pasteurisation temperatures.

(*o*) **Alkali or Over-neutralised Flavour.**

This is caused by the addition of too much neutralising agent to the cream, or by washing factory equipment with strong soda solutions and not rinsing prior to the treatment of cream. Over-neutralised cream may acquire a soapy flavour because of saponification of the fat by the neutraliser.

Remedy. Pay carfeul attention to acidity testing and neutralisation of cream; rinse all factory equipment with clean boiling water after cleansing.

(*p*) Harsh Flavour.

This is a term used to denote a defect in butter caused by the addition of too much salt, its imperfect incorporation, or the use of unrefined salt.

Remedy. Avoid over-salting of the butter, salt evenly, and thoroughly work the butter.

(*q*) Rabbito.

The butter has a putrid taint, suggestive of protein decomposition, often claimed to be like decomposing rabbits; hence the name commonly used in Australia to describe the defect. It is known in other countries as surface taint and sectional contamination, due to its often being first noticeable on the surface of the butter, or characterised by variations in a core taken from a box of butter. It is generally considered to be caused by protein-digesting bacteria, primarily of water origin, although they become established in churns and other equipment, which are thus often a more serious source of their contamination of the cream and butter than the primary source. Faulty neutralistation of cream and poor-textured, under-worked butter favour the growth of the organisms.

Remedy. Chlorinate or filter any factory water supply suspected of harbouring the causative bacteria; rigorously clean and sterilize equipment. As soon as the defect appears in butter, the cream should be neutralised to not below ·08 per cent. acidity, the salting increased and the butter thoroughly worked pending effective control by treatment of the water supply and factory sanitation.

(*r*) Hammy Flavour.

This is a flavour defect in butter resembling the taste of cooked ham. It is caused by the use of impure water—for example, untreated water and unfiltered surface water, such as dam water. When this water is used in boilers, the steam, during vacreation, transmits the flavour to the cream. Hammy flavour may also be caused by faulty operation of the vacreator, when impure condenser water happens to come in contact with the treated cream during the processing. Pollution of the water takes place when cream passes over into the vacreator condenser water.

Remedy. Use the proper treatment for and filter surface water for boiler-feed water; efficiently operate the vacreator to prevent contact of condenser water with cream and cream with condenser water.

BODY AND TEXTURE DEFECTS.

In the butter industry, the term "body" refers to the firmness and standing-up property and spreadability of butter. Texture may be defined as the character of the structure and grain of the butter.

Butter should have a firm, solid body, capable of standing up to unfavourable temperature, and a close, waxy texture. Variations in the composition of the butterfat, due chiefly to seasonal conditions, and workmanship during manufacture, largely govern the body and texture of butter.

The major defects of body and texture are as follows.

(*a*) Weak Body.

Weak bodied butter lacks the desired firmness and standing-up property when subjected to slightly unfavourable or ordinary temperatures. It is due mainly to churning to too large a grain, or insufficient

cooling of the cream prior to churning. The cream either is not cooled to a temperature low enough, or is not held at the correct cooling temperature long enough to obtain complete chilling of the fat.

Remedy. Cool cream to the correct temperature prior to churning and hold it at that temperature sufficiently long for complete and uniform chilling of the fat—at least 12 hours. Churn to a correct and uniform size of grain (about the size of a wheat grain).

(*b*) **Open Texture.**

The butter has not the desirable close, waxy texture. The defect is frequently due to underworking of the butter and is often associated with other defects which arise from the same cause, such as mottles and streak.

The remedy is obvious.

(*c*) **Greasy Texture.**

Weak-bodied butter worked excessively may acquire a greasy texture. Butter churned from cream with a very high fat content, or washed with water at too high a temperature, may also have a greasy texture.

Remedy. Use the correct temperatures for churning and wash-water and churn to grain of correct size.

(*d*) **Sticky and Ravelly Texture.**

This refers to butter which will not cut cleanly with a knife, or clings to the butter trier; also it is rag-like and tends to tear during the working process, finally sticking to the sides of the churn and butter workers. Too high a churning temperature will cause sticky butter. It is often associated with cream from cows which are drying off and so is aggravated by the dry paddock feed in late autumn and early winter or with cream produced from under-nourished cows during drought. Even slight overworking of butter made from such cream tends to accentuate the defect. Overworking of butter during any season can also cause stickiness.

Remedy. Churn at the correct temperature and to normal size of grain and avoid overworking.

(*e*) **Leaky Body and Texture.**

Under this heading free moisture will also be dealt with. The butter has a wet appearance, and when cut beads of brine or moisture can be seen. Under storage conditions, or when cut into pats, this type of butter will leak moisture and lose weight rapidly. Its flavour will also soon deteriorate.

Leaky body and free moisture are brought about by underworking. The churning of fresh cream without proper chilling, over-churning to too large a grain, washing at too high a temperature, and failing to adjust manufacturing temperatures under flush season conditions when fats are soft, are conducive to leaky butter, as they prevent the thorough working of the butter without risk of overmoisture.

Remedy. Allow freshly pasteurised cream to chill for at least three hours before churning, and churn at a lower temperature than normal; adjust churning and washing temperatures to suit the climatic conditions and season of the year; churn to the correct size grain; work the butter to a close, waxy texture.

(*f*) **Mealy Texture.**

Mealy butter lacks the smooth, waxy texture of well-made butter, and when tasted gives the impression of a mealy sawdust-like character. This defect is caused by an accumulation of hardened casein particles (from low-testing, curdy cream), or by prolonged heating of cream sometimes occasioned by a stoppage or breakdown during pasteurisation. This causes an oiling-off of the fat, which, when cooled, presents a mealy condition.

Remedy. Strain the cream into the churn and prevent the oiling-off of fat during heating.

(*g*) **Salvy Texture.**

The butter has a salvy consistency resembling lard or tallow. It is caused mainly by an abnormal, hardened condition of the fat during dry winter conditions, or by excessive dilution of the cream with water. Such cream requires prolonged agitation to bring the grain to the required size, and the granules are usually hard, round pellets of a salvy bleached nature. This type of grain requires prolonged working, which tends to aggravate the condition.

Remedy.—Adjust the cooling, churning and working temperatures to suit seasonal conditions and avoid excessive dilution of cream with water during standardisation.

(*h*) **Gritty Texture.**

The defect is usually caused by the presence of undissolved salt. If the cream is churned at too high a temperature or over-churned the salt cannot be completely dissolved during working without exceeding the permissible maximum moisture percentage. The use of a coarse salt, too much salt, or adding salt after working has commenced, may be other causes. Gritty butter may also be brought about by loosened milkstone or casein deposits from factory equipment.

Remedy.—Use correct churning temperatures and fine dairy salt; keep milkstone scale down to a minimum.

(*i*) **Crumbly Texture.**

The butter has a dry brittle condition. This is brought about mainly during cold winter weather when high melting point fats predominate. The cream, when very cold, may become solidified, causing a short hard grain. Such cream has to be steamed out of cans, which may cause oiling out of the fat. Shock cooling of cream after vacreation is prone to favour this defect in butter made during the winter, when hard fats predominate.

Remedy.—Cool pasteurised cream to, and churn at, a slightly higher temperature than normal and to a fine grain, and use low-temperature wash water; work butter sufficiently to obtain a tough waxy texture when finished. If winter vacreated cream can be partly cooled in a vat, the defect is minimised.

COLOUR DEFECTS.

The colour of Queensland butter varies from a pale straw to a golden yellow, the ideal being a bright straw. The natural colour of butter is due to yellow pigmented substances, carotene and xanthophyll, derived from pastures and green foods, and which are dissolved in

butterfat. During the flush season the plentiful green feeds contain their maximum amount of the pigments mentioned and the butter has a bright golden-yellow hue; when the paddock feed is dry the colour of butter becomes pale and, during droughts, almost bleached because of the decline in the natural pigments in the food consumed.

Salt affects the colour of butter; hence salted butter is deeper in colour than unsalted. When salt is added it dissolves in the moisture to form brine droplets. Owing to capillary attraction there follows a movement of liquid to make fewer and larger drops of water in the butter. The fewer and larger the drops of water the more yellow the butter becomes. As working continues and the droplets become smaller, the yellow colour decreases in intensity.

(a) Mottled Butter.

This is manifested by dappled spots of deeper shades of yellow throughout the butter resulting from an uneven distribution of the salt. Mottling is a serious commercial defect, as affected butter is always degraded.

The water in butter is present in the form of very numerous microscopic droplets. In freshly worked, salted butter these droplets are fairly even in size and distribution. However, if the salt is unevenly distributed, water is attracted to the spots of high salt concentration and the droplets in these spots increase in size. As shown above, the fewer larger droplets in such spots will cause a deepening of the yellow colour and so give the typical mottled appearance. The formation of larger droplets at areas of high salt concentration in this way is a fairly slow process and this is the reason why mottle is seldom seen until two or three days after manufacture of the butter.

Mottling is brought about by faulty cooling, churning and washing temperatures, which give a soft, weak-bodied butter incapable of being thoroughly worked to incorporate the salt; over-churning to too large a grain or uneven size of the butter grains; uneven distribution of the salt; using too coarse salt which dissolves too slowly; insufficient working of the butter; overloading of churns or mechanical defects which prevent the churn rollers from evenly working the butter.

Remedy.—Pay strict attention to cooling, churning and washing temperatures to suit the seasonal conditions; churn to a fine, even grain (about the size of wheat); spread salt evenly over the butter in the churn; if salt is coarse, crush it, or resort to damp salting, that is, wetting the salt with water after spreading in the churn; before engaging workers revolve the churn for a short time in low gear to help distribute the salt; work the butter until a compact, waxy texture is obtained; avoid overloading the churn, and keep it in sound mechanical condition.

(b) Streaky or Wavy Butter.

Instead of being a uniformly even colour, the butter is marred in appearance by waves and streaks of different colours throughout its mass. The defect is caused by uneven working of portions of the butter in an overloaded churn, faulty churn rollers, churn barrel not being level, or uneven moisture distribution. Remnants of butter from different churnings put together, the surface of butter becoming greasy while awaiting packing in hot weather, and reworking of over-moisture butter, are other causes.

Remedy.—Avoid overloading the churn; see that the churn is maintained in good mechanical condition and the rollers properly adjusted; avoid the packing of butter remnants from one churn with butter from another churn.

Pack butter as quickly as possible. In hot climates a temperature-controlled packing room is recommended. Do not handle butter with the bare hands. Take care in moisture control to avoid the necessity of reworking the butter.

(*c*) **Dull Colour.**

The butter lacks the desired bright straw colour. This defect is caused by drought conditions and dry feed, or excessive dilution of cream with water prior to churning.

Remedy.—If necessary, add a little artificial butter colouring to the cream prior to churning; avoid excessive dilution of cream with water.

(*d*) **Speckled Butter.**

White specks in butter may be due to small pieces of coagulated casein. By straining all cream into the churn from the holding vats this may be avoided.

Yellow specks may arise from over-chilling of soft butter grains by cold wash water running on to one spot in the churn. The remedy is to use wash water not more than 4 deg. F. lower than the churning temperature and to spray the water over the whole surface of the butter.

BUILDING NOTES.

Many farmers will be interested in a series of "Notes on the Science of Building," issued free by the Building Research Liaison Service, P.O. Box 2807AA, Melbourne.

These notes are in the form of a two-page leaflet, well illustrated with photographs and diagrams. Titles of numbers so far issued are:—

1. Design for climate.
2. Footings for small masonry buildings on sand, gravel, or rock.
3. Roofs—ventilation and insulation.
4. Reinforced brickwork lintels.
5. Mortars for brickwork.
6. Footings for small masonry buildings on plastic soils.
7. Attic exhaust fans for summer cooling.
8. No-fines concrete.

DEHORNING OF CATTLE—CORRECTION.

A sentence inserted by error in the article on dehorning of cattle which appeared in the October issue made it appear that pliers were recommended for stopping bleeding from an artery. Artery forceps are used for grasping a cut artery for tying off.

Cobalt Deficiency of Sheep In Queensland.

G. R. MOULE and R. B. YOUNG, Sheep and Wool Branch.

RESEARCH work carried out in South Australia and New Zealand during the last few years demonstrated that cobalt is essential to sheep for their normal growth and wellbeing.

Cobalt is a metal closely related to zinc, manganese and nickel, all of which are well known for their commercial uses. The cobalt in the soil is taken up by plants, or it contaminates the pastures as part of the dust which blows about so freely during average seasons in the pastoral country. On being consumed by grazing sheep, cobalt is used by some of the bacteria in the paunch, which make compounds essential to the formation of red blood cells. When sheep suffer from cobalt deficiency, they are unable to make sufficient red blood cells and as a result their growth rate is decreased. In extreme cases affected sheep lose condition, and quite heavy mortality may occur if the flock is left untreated.

Cobalt deficiency was diagnosed amongst sheep in Queensland for the first time during the winter of 1950. The factors which led to its sudden appearance are not clear. The abnormally heavy rain promoted rapid growth of pasture plants, but may have decreased the rate at which they absorbed cobalt from the soil. In addition, the continued wet weather and heavy ground cover probably prevented contamination of the grass with dust.

SYMPTOMS OF COBALT DEFICIENCY.

Weaner sheep are most commonly affected by cobalt deficiency, and as far as is known its occurrence during 1950 was restricted to sheep of this class, although a detailed examination was not made of older animals for evidence of the complaint.

The symptoms of cobalt deficiency might be classified as mild or serious, depending upon the time the deficiency lasts or on its severity.

Decreased growth rate of weaners is the most important symptom of mild cobalt deficiency. In the majority of cases it is manifest as a transitory check, which may remain unnoticed.

Should the deficiency be maintained for four or five months and be severe, mortality may occur, and a large proportion of the weaner flock will show evidence of extreme malnutrition, despite ample feed.

By keeping a careful check on the liveweight of young sheep, it has been found that weaners suffering from cobalt deficiency may lose ¾ to 1 pound a week, whereas unaffected animals may gain a comparable amount in the same time.

As the disease progresses, the affected sheep become very thin and listless (Plate 191); they are incapable of travelling and are disinclined to eat. They assume a typical stance with backs arched and heads lowered. Ears are drooped, and the sheep appear to be completely disinterested in their surroundings, as the upper eyelids remain half

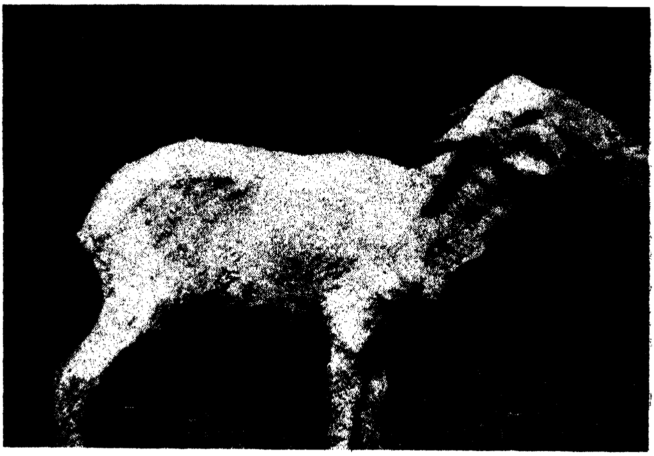


Plate 191.
Sheep Affected by Cobalt Deficiency.—Note the loss of condition and the dejected appearance.

Plate 192.
Head of Sheep Suffering From Cobalt Deficiency.—Note the dull eye and watery discharge matting the wool on the side of the face.

closed. The eyes are dull and lifeless and there is often a watery discharge from each eye (Plate 192), although there is no sign of inflammation. In some animals, this discharge is so profuse that it mats the hair on the side of the face, and as there is a copious flow of tears down the duct leading from the inner corner of the eye to the nose, a clear fluid sometimes drips persistently from the nostrils.

The skin is pale and lifeless and the fleece tender. In extreme cases, the skin is fragile and may tear away when a staple of wool is suddenly plucked.

Very little is to be seen on post-mortem examination. The carcase is thin and wasted and contains comparatively little blood. Sometimes the marrow in the shank bones is redder and more jelly-like than usual, but generally speaking there are very few characteristic changes.

OVERCOMING COBALT DEFICIENCY.

Before taking steps to overcome cobalt deficiency affecting sheep, it is essential to make certain as to the cause of the symptoms which are exhibited.

The symptoms of cobalt deficiency are quite like those manifest by sheep affected with moderate infestations of round worms, or which are on drought rations, or which are suffering from copper deficiency. In these circumstances, care should be taken in making a correct diagnosis before attempting treatment, and wool growers who suspect cobalt deficiency amongst their sheep would be well advised to seek the assistance of the technical services offered by the Department of Agriculture and Stock.

Cobalt deficiency is easily overcome by arranging a small regular intake of cobalt. In areas where drenching is practised it is a simple matter to add a cobalt salt, such as cobalt chloride or cobalt sulphate, to the drench. However, as the cobalt is not stored it is necessary to drench the sheep every week, and this may mean a considerable amount of work.

In areas where salt licks are fed, the cobalt salt can be incorporated in the lick at the rate of 2 oz. per 1,000 sheep per week. The easiest way of getting an even distribution of cobalt is to dissolve it in a small quantity of water, which can be sprayed over the salt lick during mixing.

The disadvantages of using a cobaltised lick are:—

(1) Expense and labour are involved.

(2) The cobalt intake of the whole flock is erratic and some sheep will not take licks. This is particularly likely to occur during good seasons, when cobalt deficiency may be more prevalent.

In districts where neither of these methods is practicable, it is possible to give the sheep cobalt through the drinking water. To be successful, this method must allow for a fairly continuous supply of cobalt in the water. This may be attained by adding the cobalt salt to the supply tank. Alternatively, it may be placed in a small metal cylinder (Plate 193) about 18 inches long and 1½ inches in diameter, with one end closed and a hole about 3/64 of an inch in diameter drilled about 1 inch from the closed end. A small piece of metal gauze is placed in the bottom of the cylinder, so that it extends to above the level

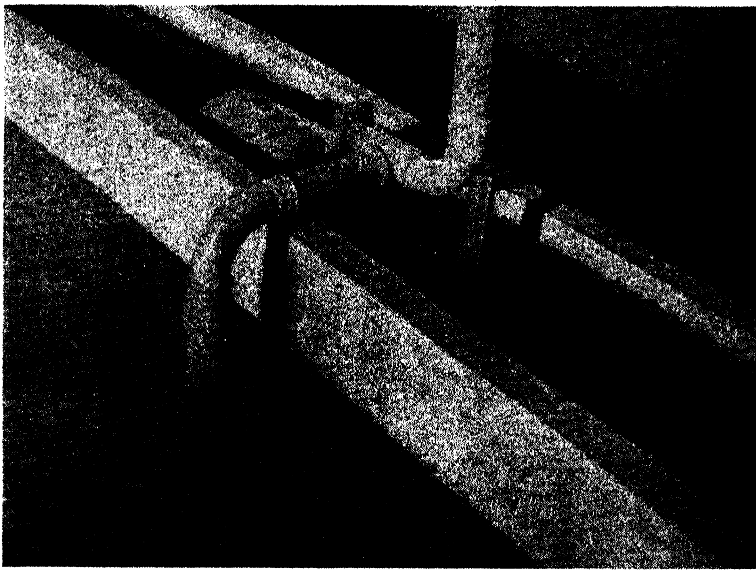


Plate 193.
Cylinder For Feeding Cobalt Salt Into Drinking Water.

of the small hole. The cylinder is supported in the trough near the float valve, and the requisite amount of cobalt to supply the sheep in the paddock for one week, calculated at the rate of 2 oz. per 1,000 sheep, is added to the cylinder. The water, which enters the cylinder through the small hole, becomes saturated with cobalt and gradually finds its way out of the hole. Additional cobalt is added each week. The preferable method is to have duplicate cylinders for each trough. The weekly amount of cobalt to be given to the sheep in any one paddock is weighed out and placed in the spare funnel. When the troughs are visited as part of the routine inspection, the funnel containing the cobalt can be placed in the trough and the empty cylinder withdrawn and recharged for use again during the ensuing week.

Cobalt salt can be added slowly to a running bore drain instead of to the supply tank or trough, and while this method is more expensive because of greater quantities of material used, it can be quite effective. In either case, it is as well to seek the opinion of the Department as to the suitability of the water for the addition of cobalt.

The disadvantage of supplementation through water is that when alternative sources of surface water are available the sheep will often prefer them and not return to the troughs until forced to by dry or hot weather.

The fourth method of overcoming cobalt deficiency is spraying the pasture with a finely atomised solution of a cobalt salt. The sheep should be yarded overnight and in the morning shepherded on the sprayed areas.

In the event of this method being used, wool growers would be well advised to discuss the details with Departmental officers.

ANIMAL HEALTH

Brucellosis (Contagious Abortion) In Cattle.

A. L. CLAY, Assistant Director, Division of Animal Industry.

DEFINITION AND CAUSE.

THE term "brucellosis" confuses many people. To add to the confusion many American writers refer to contagious abortion of cattle as "Bang's disease," a name derived from that of the man who discovered the cause of the disease in 1896. It is well, therefore, to know the derivation of the term brucellosis and why it is preferred to the older name, contagious abortion.

The term brucellosis comes from the name given to a group of micro-organisms of a rather special type, which cause disease in man, cattle, pigs, goats and horses. The first man to discover one of these organisms was David Bruce. He made the discovery in 1887 when investigating a disease of human beings known as Malta or Mediterranean fever, and called the organism *Micrococcus melitensis*. Some 30 years later (in 1918) the relationship of this disease to contagious abortion of cattle was revealed. Since that time the organism causing Malta fever has been named *Brucella melitensis* in honour of the discoverer, and the organism which causes contagious abortion of cattle, previously known as *Bacillus abortus*, has beeen renamed *Brucella abortus*.

Brucellosis simply means "disease due to *Brucella* organisms." It is a specific disease which can occur only in the presence of these organisms. The term can be used to describe the disease whether it occurs in man, cattle, pigs, goats or horses, and when it is used no room is left for confusion because it can mean only one thing, that is, disease due to *Brucella* organisms. No other term has this advantage.

Additional reasons why the term brucellosis is to be preferred are as follows:—

(1) There is more than one kind of abortion in cattle which is of a contagious nature, so that when different people speak of "contagious abortion" they may be speaking of quite different diseases.

(2) Some cows affected with brucellosis do not abort at all; and many, though they abort once, carry subsequent calves to full time.

(3) There are other important consequences of brucellosis in cattle quite apart from abortion. Such are sterility, difficulty in rearing calves, and lowered production.

ECONOMIC IMPORTANCE.

Losses caused by brucellosis in cattle are often very considerable, so much so that individual farmers have sometimes been virtually forced to give up dairying because of the ravages of the disease. No reliable estimate is available of the loss to the dairy industry in Queensland or the other Australian States, but there can be no doubt that it is huge.

The losses in affected herds are largely the result of lowered milk production. It is universally accepted that production in an infected herd compares unfavourably with that in a "free" herd, all other things being equal. The lower milk production in infected herds is due to calving taking place before full term, delay or even complete failure of cows to prove in calf, and the prolonged ill-health which is sometimes the aftermath of an abortion, especially if accompanied by retention of the afterbirth.

A very large number of cows is disposed of each year as "tinners" because of sterility consequent upon brucellosis.

The serious position created in stud herds by the birth of dead calves or of weak calves which are difficult to rear is obvious.

Finally, the presence of brucellosis may lead to quarantine restrictions, direct or indirect, on farms, districts, or even whole States. No cattle can be imported into Australia unless they are free from brucellosis. Within Queensland, because of the prevalence of the disease, quarantine is imposed only in exceptional circumstances.

DISTRIBUTION AND INCIDENCE.

Brucellosis is world wide in its distribution. In Queensland it occurs in all the recognised dairying districts and for the most part must be considered as prevalent.

The disease occurs in beef cattle but is not of comparable importance to the disease in dairy cattle. There are exceptions, especially in stud beef herds, where the degree of contact between the animals therein approaches more closely that found in dairy herds.

HOW COWS BECOME INFECTED.

For the most part brucellosis is brought into a herd with purchased cattle. Buying replacement cattle at a saleyard is attended with the risk of purchasing infected animals; it should be avoided if at all possible. There is also some risk when making purchases at "clearing sales," as it may perhaps be that the "clearing out" process is in some measure the consequence of the ravages of brucellosis.

Straying cattle may introduce the disease. Sending cattle to other farms (as for service) or taking them to Shows and then returning to the home farm may introduce the disease. Dogs, foxes, and perhaps crows may act as mechanical conveyors of infective material.

Drainage from adjacent infected farms may be responsible for introducing infection.

Brucella microbes are frequently present in the milk of affected cows. This infection may occasionally be transmitted on the hands of milkers, especially to cows with abrasions on the teats.

Experimentally, cows have been infected through the eye and the skin, but these are not considered common ways of infection under natural conditions. It can, however, be noted that infection by way of the eye is easily effected and is the method of choice when it is desired to set up infection deliberately, as when testing the efficacy of vaccines. This permits of speculation as to whether flies act as mechanical conveyors of the disease, but so far proof is lacking.

There can be no question, however, that introducing and maintaining infected animals in a herd is by far the most important source of infection.

Pasture Contamination.

Whether they abort or carry their calves to full term, infected cows discharge from the breeding passage, for some weeks, large numbers of micro-organisms, which contaminate the hindquarters, pasture, water supply, &c. Since most cows are infected by way of the mouth, contaminated pasture represents the most common source of infection.

The droppings from calves fed on infected milk may contaminate pastures, the microbes passing right through the calves' digestive tracts without being destroyed.

The survival of *Brucella* microbes on pasture is obviously a matter of great importance. Survival is longer in winter than in summer, and at any time of the year is longer in a situation protected from the direct rays of the sun.

The longest survival time noted under experimental conditions in Australia was between 90 and 100 days. The survival time was consistently longer for microbes in the afterbirth itself as compared with microbes in discharges.

Pastures are probably quite safe three months after the removal of infected stock in summer and four months in winter.

Infection from the Bull.

The part played by the bull in infecting cows has been the subject of much misunderstanding. It was originally thought that service by infected bulls was a common source of infection. Later investigations suggested very strongly that infected bulls did not transmit the disease in the act of service, except perhaps in rare instances. Recently, however, Danish veterinarians have shown that some bulls can transmit the disease with some degree of regularity during service, more especially when their semen is used for artificial insemination.

Though many infected bulls fail to transmit brucellosis by service it has now to be recognized that some may do so and the use of such bulls may cause rapid spread of infection in a herd.

Infection from Other Animals.

Brucellosis of pigs requires some consideration in relation to mode of infection of cattle. The causal microbe in swine is known as *Brucella suis*, and though similar to *Brucella abortus* is not quite the same thing. Cattle are susceptible to *Brucella suis* but infection is not common. When it does occur it is a serious matter from the public health standpoint.

Fistulous withers in horses is sometimes due to *Brucella abortus*, or at all events the latter is present in the lesion. Horses with fistulous withers, especially if the lesion is discharging, are therefore a potential danger to cattle.

SUSCEPTIBILITY OF DIFFERENT CLASSES OF CATTLE.

Some cows are much more susceptible to infection than others. In herds that have been blood-tested annually without removing reactors it has been noted that some animals remain negative to the test year after year despite the presence of many infected animals in the herd. These negative animals have certainly been exposed to infection on numerous occasions but the infective agent does not become established in the

cow. Such cows have a natural resistance to brucellosis. They constitute a varying percentage of the cows in different herds--usually 20 to 30 per cent. but sometimes considerably less.

Calves are rather a special case. Nearly all calves have a high resistance to infection, at all events until six months old. This is so whether the infection is natural or artificial (for example, by inoculation with living vaccines). From six months onwards the resistance decreases but is often evident even at 12 months of age. Resistance in calves is considered by some authorities to be connected with the lack of development of the sexual organs. Once these attain full development—that is, when the calf becomes capable of breeding—then susceptibility to infection increases very markedly.

The in-calf cow is more susceptible to infection, or at all. events to the ill-effects of infection, than the not-in-calf cow. Abortion is much more likely to follow if infection occurs during pregnancy, except that if infection occurs after the seventh month there may not always be sufficient time for the *Brucella* microbes to cause enough damage in the uterus to bring on an abortion. Infection taking place while a cow is "empty," or during the very early stages of pregnancy, is quite often followed by an apparently normal calving.

It will be seen that infection with *Brucella* microbes need not necessarily result in the calf being aborted.

PERIOD OF INCUBATION.

This is subject to a great deal of variation. There is now some evidence to show that in the case of the in-calf cow it varies inversely as the stage of development of the foetus at the time of infection; that is, the younger the foetus at the time of infection the longer is the incubation period. This explains why few brucella abortions occur before the fifth or sixth month of pregnancy.

It is also necessary to remember that the size of the dose of infective material has a bearing on the length of the period of incubation. Large doses tend to shorten and small doses to lengthen the period.

The period of incubation may exceed six months.

SYMPTOMS.

The most obvious symptom is the. failure of cows to carry their calves to full term, the calf being aborted usually at about the fifth month of pregnancy, though sometimes earlier. However, calves may be carried to full or nearly full term and be born dead, or, if born alive, be small and weak. Further, in these cases there is often retention of the placenta (that is, failure of the cows to get rid of the afterbirth).

Sterility is a matter of very real concern in the great majority of heavily infected herds and is due to the abnormal uterus (womb) which prevents conception. Brucellosis would be less serious than it is if, following abortion, the uterus always returned to its normal healthy state and so allowed of another pregnancy being got under way. Unfortunately, such is often not the case, cows being left with a chronic inflammation of the womb. The condition is very difficult to treat because the organ is so inaccessible.

Calves born of affected dams are prone to scours and pneumonia.

A less frequent indication of the disease is the presence of swellings on various parts of the body. Sometimes these swellings are associated with joints, the knee joint being the one most commonly affected. On

the other hand, the swellings may have no association with a joint; in these cases they occur commonly on the sides of the neck, on the withers, in the flank or over the hip. The swellings in the neck regions may be very large and contain a gallon or more of fluid.

In the bull there may be swelling of one (usually) or both (sometimes) testicles, but such is not necessarily the case.

None of the symptoms described can be regarded as enabling certain diagnosis of brucellosis. This can be done only after use has been made of the "blood test."

As has already been noted, once cows abort as the result of brucellosis they will in most cases carry subsequent calves to full term, always provided they remain capable of breeding. It is important to recognize that such cows remain infected. This is of great importance in assessing the results obtained from the administration of "cures" or "remedies."

POST-MORTEM CHANGES.

The disease does not cause death of the dam, but if the animal is killed and examined, the only sign found is an inflammation of the uterus. Even this is not constant.

The afterbirth which is shed following the delivery of a dead calf usually (but not always) shows some abnormalities. The cotyledons are a dirty-yellow colour and gelatinous in consistency. The membranes as a whole may be infiltrated with a yellow gelatinous material. Most suggestive of all is the presence of areas in the membranes which can be described as leathery in texture.

DIAGNOSIS BY BLOOD TESTING.

One can suspect the presence of brucellosis in a herd but there is only one way of making certain, and that is to submit blood samples from suspected cattle to a laboratory for test. The test is correctly referred to as an agglutination test, but is commonly spoken of as a "blood test." The test is done on the serum—that is, the clear yellowish fluid which separates out from blood after it has clotted. The serum is mixed with a suspension of *Brucella* microbes in a series of small glass tubes. The mixture which results is cloudy. The tubes are then placed in an incubator for 48 hours, after which time the test is read (Plate 194).

The test works by reason of the presence of certain "antibody" substances in the blood of infected animals. When these substances in the blood serum come into contact with the *Brucella* microbes in the tube, they cause them to clump together or agglutinate (hence the name agglutination test). Having done so they are no longer capable of remaining suspended in the liquid, and sink to the bottom of the tube, leaving a clear fluid above.

The test is reliable to an extraordinarily high degree, but it is not infallible.

A disadvantage is that the development of anti-bodies in the blood (consequent upon infection) is occasionally a very slow process. Added to this is the fact that the period between the demonstration of anti-bodies and the occurrence of abortion is sometimes very short, and in some cases abortion may actually precede the appearance of anti-bodies. The situation sometimes arises therefore where an eradication programme is believed completed and testing suspended only to have an animal abort and start a fresh cycle of infection.

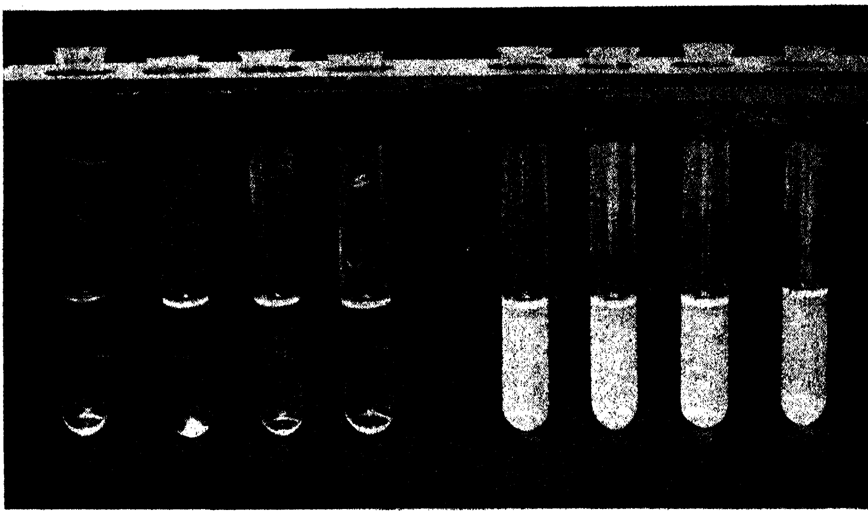


Plate 194.

Agglutination Tests.—Left, positive tests; right, negative tests. In a postive test the mixture in the tube becomes quite clear and the microbes which were responsible for the cloudy appearance settle on the bottom of the tube as a distinct deposit or sediment. In a negative test the cloudy appearance remains and no deposit forms at the bottom of the tube.

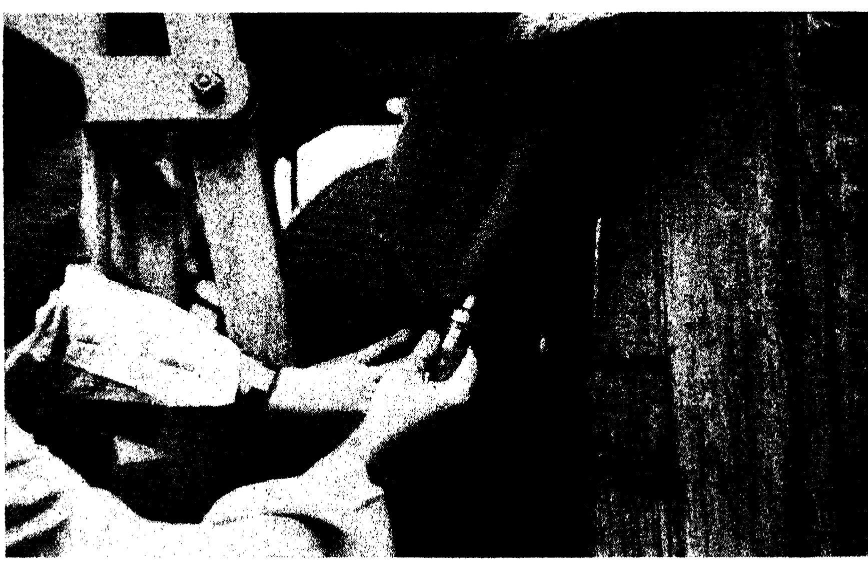


Plate 195.

Collecting a Blood Sample.—Note tourniquet or bleeding strap applied so as to cause distension of the jugular vein. The needle is inserted into the vein with a quick thrust; then, the sample having been collected, the tourniquet is loosened **before** the needle is withdrawn from the vein.

A small percentage of reactors do eventually cease to react, but it is not possible to say with certainty that they cease to be carriers of infection. All reactors should be regarded as permanently infected.

Taking Samples for Testing.

Blood samples may be obtained from the ear, the tail or the jugular vein. The jugular vein is by far the most satisfactory (see Plate 195). A stout hypodermic needle about three inches long is required, and a device known as a King bleeder to hold both the needle and the bottle into which the sample is drawn greatly facilitates the procedure.

The cow's head should be secured firmly to a rail or post. A strap or cord is then looped round the animal's neck and pulled taut. This results in the jugular vein becoming prominent, whereupon the needle is inserted with a quick thrust and the sample collected. The strap is then loosened and the needle withdrawn from the vein.

A sword-type bail is very useful for bleeding cattle and can be installed at the exit end of a crush.

GENERAL FARM PRECAUTIONS.

In the absence of an attempt to eradicate the disease altogether, there are certain general precautions which should be taken.

(1) Isolate all cows that abort or have premature calves, such isolation to continue until all traces of discharge have disappeared. During the isolation period (especially the early part) syringe out the cow with a reliable antiseptic solution to minimize the output of live *Brucella* microbes. "Dettol" and "Lysol" (1 fluid oz. to 1 gallon of lukewarm water) are examples of suitable fluids. About one quart should suffice for each cow unless the amount of discharge is exceptionally large.

The person carrying out this work should wear gum boots and either remove them just prior to leaving the isolation paddock or else disinfect them thoroughly.

(2) Do not use a known infected bull if it can be avoided. Do not put cows mentioned in (1) to a non-infected bull for at least six weeks after they have aborted or calved.

(3) Locate the foetus and the afterbirth (if not retained) and burn them and fire the grass in the immediate vicinity. If this is too much of a fire risk, then disinfect as efficiently as possible. The foetus and afterbirth are the main source of infection.

(4) Keep the tail and buttocks of all cows free from matted discharge. This material may be teeming with *Brucella* microbes. Warm soapy water will make the task an easy one.

(5) Watch cows carefully for signs of impending abortion with a view to getting them into isolation before the event takes place.

(6) Rear all herd replacements on the property, but if purchases must be made, then buy only from herds which are beyond reproach, or if your herd is already infected buy animals which have been vaccinated as calves.

(7) As a general rule it is best to dispose of infected cattle in the late spring or early summer, for the reason that residual infection on pasture will die out quicker at that time of the year.

(8) Send to slaughter cows known to be infected and which fail to prove in calf after a reasonable period.

In the absence of precautions as outlined, a certain "balance" eventually comes about in an infected herd and a farmer perhaps comes to think that brucellosis is after all not a matter of any great account. Now, though it is well recognized that brucellosis is self-limiting, the disease leaves many cows sterile. The average number of services by the bull per live calf may rise as high as five, the calf crop itself may come down to 50 per cent. of the cows annually, production comes down, and wastage through having to cull barren cows is heavy. In such herds the percentage of heifers that abort is often very high indeed; moreover, as the abortion takes place while the animals are still growing the ill-effects are accentuated.

TEST-AND-SLAUGHTER METHOD OF CONTROL.

For many years test and slaughter has been an important means of control. Until comparatively recent times it was the only worthwhile method available.

The blood test enables the animals in a herd (as at the date of test) to be catalogued as infected, possibly infected, and not infected. They are referred to as positive, suspicious, and negative, respectively. Obviously, if all the infected animals—and to be on the safe side, the possibly infected ones also—are removed, the remaining herd is composed exclusively of non-infected animals. However, the infection present on the pastures grazed by the infected cattle will remain for about three months and during that time some of the non-infected animals may become infected through grazing on those pastures. It must also be recognized that there may still be animals in the herd which though actually infected have not arrived at the stage where they react to the blood test. To counter this situation, what remains of the herd is retested at 30-day intervals until a "clean" test is obtained. After the second and each subsequent test the positive reactors are eliminated, but suspicious reactors are often held until the next test and, as it were, given another chance.

It is necessary to get two "clean" tests at an interval of not less than 90 days before a herd can be accepted as free from the disease. The number of tests that has to be applied before this requirement is met varies greatly and there is no way of forecasting it. The number of cattle that has to be liquidated also varies greatly; it is again difficult to forecast. The procedure meets with earlier success on some farms than others, but the reasons are not always apparent.

The cost of this method may be considerable and there are many farms on which it cannot be justified in the light of present-day knowledge. It does have attractive features if a man has two farms, on one of which he can run all the reactors (infected cattle) and on the other the "clean" (non-infected) cattle.

Having "freed" a herd from brucellosis it has often happened that the disease is re-introduced at a later date despite all practicable precautions having been taken. This is a most serious drawback to the method. If in the process of obtaining a "free" herd a "resistant" herd were acquired, then the method would be much more attractive. It has become usual in Queensland to advise against attempts at eradication of brucellosis if infected cattle detected at the first test exceed 15 per cent. of the herd. Nevertheless, on some farms the test-and-slaughter method of control has been used to the complete satisfaction of all concerned even when the initial infection in the herd has been comparatively high.

It is much more attractive when testing is being carried out on an area basis—that is to say, testing is carried out on a group of adjacent farms at one and the same time. This largely eliminates the risk of re-infection.

In deciding on whether to control brucellosis by test and slaughter the following considerations must be kept in mind—

(1) Danger of re-infection after the herd has been "freed" from the disease.

(2) Economic value of the animals in the herd, including a consideration of their value as meat.

(3) Percentage of animals found infected on the occasion of the first test of the herd.

(4) Is the herd self-contained?

In general it can be stated that stud herds with a low initial infection are the most suitable herds in which to use the test-and-slaughter method. Grade herds that are not self-contained present difficulties which are not easy to overcome.

CONTROL BY VACCINATION.

Control by vaccination has been attempted ever since the bacterial nature of brucellosis was first discovered 50 years ago. It was early evident that dead vaccines had no immunizing effect against the disease and that living vaccines must be used. It was also evident that the virulence (power to produce disease) of the microbes in the vaccine must not be reduced in any way otherwise the immunizing power would be correspondingly reduced. The use of such fully virulent live vaccines had serious disadvantages. Abortions were prevented but the disease itself was perpetuated; the infection became established in the vaccinated animals and was shed in the afterbirth and milk, thus exposing other animals as well as man to the risk of infection.

In Australia the use of fully virulent live vaccines has at all times been prohibited.

Strain 19.

In 1925 Buck, working in the United States of America on an attempt to improve vaccination against brucellosis in cattle, came across a strain of *Brucella abortus* (since known as Strain 19) which was of considerably less virulence than is usual with this organism. Later Buck tested this strain as a vaccine and concluded that, notwithstanding its lower virulence, it was capable of producing a serviceable immunity. Buck's findings have been confirmed by many later investigators and Strain 19 vaccine is being used extensively in many countries.

Advantages and Disadvantages.

The chief advantage of Strain 19 is that it does not become established in the vaccinated animal other than in exceptional circumstances; and it never does when its use is confined to calves. Moreover, it does not become localised in the udder and hence is not shed in the milk.

It does not spread disease from vaccinated to unvaccinated animals. Vaccinated calves are no danger to unvaccinated cattle and do not require to be isolated for any period following inoculation.

When properly applied, Strain 19, apart from some local swelling at the site of inoculation, is not harmful to the animal in any way whatsoever.

The main disadvantage of Strain 19 is that the immunity conferred by it is not absolute. If the degree of exposure to infection is high enough, then the vaccinated animal will in many instances contract brucellosis. There is also a difference of opinion as to how long the immunity lasts. This is quite understandable because a number of factors enter into the matter, as, for example, the extent and severity of exposure to infection and the response of the individual calf to vaccination. These are all subject to great variation. Immunity is at its highest a few weeks after vaccination and then falls very gradually. Experimental evidence indicates immunity is of quite long duration.

The important thing is whether Strain 19 vaccine helps to bring brucellosis under control. There can no longer be any doubt on this point; its use is certain to effect improvement when intelligently applied. Abortions are not eliminated altogether but they are reduced to a point where they cease to be of any great consequence. Accompanying this is a decided improvement in the fertility level in the herd, easier rearing of calves, and increased production generally.

It is of great importance to realise that, although Strain 19 vaccine has proved itself on the farm as well as in the research centres, it must not be looked upon as a substitute for good sanitation and herd management. To do so is to invite disappointment.

There is no truth in the suggestion that Strain 19 leaves many heifers unable to breed. The experimental evidence in this regard is very clear; no difference can be discerned between the breeding capacity of vaccinated and unvaccinated heifers.

Precautions to be Observed.

In Queensland the use of Strain 19 vaccine is subject to permit, firstly because it consists of living organisms to some extent dangerous to man, secondly because it must be used under special conditions. For these reasons its use is confined to approved persons—that is, veterinary surgeons and certain officers of the Department of Agriculture and Stock.

All who carry out vaccinations are required to undertake to observe the following conditions:—

(1) No male cattle to be vaccinated.

(2) No pregnant animal, irrespective of age, to be vaccinated.

(3) No animal over 12 months to be vaccinated.

(4) As far as possible vaccination to be confined to calves between the ages of 4–8 months.

(5) Records of all calves vaccinated to be kept.

Calves under four months of age are not vaccinated for the reason that many of them fail to "take" and little or no immunity results.

No bull calves are accepted for the reason that bulls are normally more resistant to infection than females. Vaccinal reactions are also more persistent in males than in females.

Vaccination of adult cattle is not permitted in Queensland for the following reasons:—

(1) Permanent infections may be set up.

(2) Long-lasting positive reactions to the "blood test" are set up in nearly all cases.

(3) The local reaction to vaccination is very often severe and a permanent lump may remain at the site of inoculation.

(4) Milk flow is often seriously depressed for 2-3 weeks following inoculation with the vaccine.

(5) As vaccination of adult cows (even if practised) must be carried out when cows are "empty," a series of visits must be made to each farm before all the cows can be inoculated. The problem involved here is considerable, and in combination with the other disadvantages has brought vaccination of adult cows into disfavour.

(6) Vaccination of adult cattle which are already infected is in any event useless.

Abortions in Heifers Vaccinated as Calves.

In this State, as in other States of the Commonwealth, there have been some reports of abortions in vaccinated heifers. This is in accordance with what has been reported from other parts of the world. Strain 19 vaccine does not give absolute protection. It is, however, now becoming evident that some of these abortions are not due to *Brucella* abortion at all but to infection with other types of micro-organisms known as *Vibrios* and *Trichomonads*. This is not altogether surprising, as the protection afforded by Strain 19 vaccine against *Brucella* abortions was bound to bring these other types of abortion into greater prominence.

Vaccine Supply and Costs.

The vaccine is put up in bottles containing 100 c.c., or sufficient for 20 calves, the dose being 5 c.c. As the vaccine is comparatively costly, waste should be avoided. It is desirable that groups of farmers get together to ensure that as near as possible to 20 or multiples of 20 calves are available in the one locality for inoculation on any one day.

The charges made for inoculation by private veterinary surgeons will naturally have some relation to the number of calves and the distance travelled. The Department of Agriculture and Stock charges 2s. per calf as a flat rate, but it is only reasonable to expect that as the distance travelled increases so should the number of calves.

Indications for Vaccination.

Vaccination is especially suited to those herds which are already heavily infected. There is, however, a case for vaccination in any herd whenever the danger of infection or of re-infection exists. In all heavily infected herds all the calves should be vaccinated, and in fact in any herd where the danger of infection or re-infection exists vaccination is clearly indicated.

Vaccination and Blood Testing.

Vaccination and the use of the blood test may be combined to advantage. Vaccinations must be restricted to heifer calves not older than eight months. This is for the reason that vaccination with Strain 19 is followed by the development in the blood of those anti-body substances which are responsible for a positive reaction to the "blood test." This is to be expected and in fact is looked for as evidence that the vaccine has "taken." This positive reaction in vaccinated calves has quite a different significance from that given by animals which have contracted the natural disease. In the former case it indicates only a

temporary infection with no danger of organisms being shed by the animal; in the latter case it indicates a permanent infection with every prospect of organisms being shed by the animal.

The positive reaction due to vaccination gradually fades; but the older the calf at the time of vaccination, the longer the reaction lasts. Once the vaccinated calf reaches the age when a natural infection becomes a possibility, confusion and doubt as to the significance of the positive reaction become inescapable. The reason for this is that the "blood test" does not enable us to distinguish between a reaction due to vaccination and one due to natural infection. If careful records are kept of the animals vaccinated as calves there is less room for doubt but it cannot be removed altogether.

It is for the reasons stated that, when combining vaccination with the use of the "blood test," the age of the calves which are vaccinated must be kept lower than would otherwise be the case. Even so, in order to retain a "negative" herd it may still be necessary to dispose of a small percentage of vaccinated calves because they fail to return to a "negative" state.

Quite recently certain modifications of the "blood test" have been evolved which give hope of enabling us to distinguish between the two types of reaction. If this eventuates it will be a notable advance.

The main advantage of combining vaccination with the "blood test" is that an owner can look forward to having a "resistant" as well as a disease free herd and thus help materially to eliminate the possibility of re-infection.

In the early stages of an eradication programme the combination also enables the financial loss to be spread by disposing of reactors over a longer period. There is not the same pressing urgency about disposing

Plate 196.

Inoculation with Strain 19 Vaccine.—The injection is made low down on the side of the neck almost over the brisket. Note the loose skin, which makes the injection easier and safer for the operator and allows ample room for local swelling caused by the vaccine without detriment to the calf.

of all infected cattle, as the young stock are protected (by vaccination) before they reach a susceptible age. This is especially attractive to owners of stud herds in which a medium to high initial incidence of infection exists. Eradication can come four or five years later when the herd is composed largely of animals that have been vaccinated as calves.

Vaccination as an adjunct to "test and slaughter" should be seriously considered whenever the risk of re-infection of a "free" herd can be regarded as real. The consequences of this latter can be extremely serious.

Time to Start Vaccination.

Calfhood vaccination with Strain 19 is a long-term project, no matter what the circumstances in which it is used. It takes at least two years to obtain useful results in even small measure, and 4–6 years must elapse before a herd can be obtained which is composed entirely of vaccinated animals. It is very necessary to realize this and not postpone vaccination until the disease strikes. The time to start vaccination is NOW.

USE OF DRUGS.

The cure of brucellosis by the injection of various chemical substances has in the past been the subject of many claims by different people. A very popular "cure" was a weak solution of carbolic acid administered as a hypodermic injection. This in common with many others has been shown to be useless.

With the advent of the sulpha drugs high hopes were held, but these too proved useless. Even penicillin and streptomycin have been found wanting.

A more recent product known as aureomycin holds promise, but is not yet in the realm of practical farm use, being very expensive as well as not readily available for veterinary purposes.

Douching or syringing the vagina with antiseptic fluids helps to reduce the amount of infective material dispersed by affected animals but is not a cure of the disease itself.

RELATION OF BRUCELLOSIS TO VAGINITIS AND MASTITIS.

All three conditions are often seen in a herd at the same time but they are quite unrelated. Vaginitis is often seen in herds that have been proved by "blood test" to be free from brucellosis. Treatment of vaginitis will have no influence on brucellosis should the latter be present in the animal.

With regard to mastitis, it is necessary to note that *Brucella abortus* is found in the udder of infected cows. Its presence does not, however, cause any inflammation of the udder and is not considered to have any bearing on whether the cow will or will not become affected with mastitis.

RELATION TO HUMAN DISEASES.

Both *Brucella abortus* and *Brucella suis* can cause undulant fever (brucellosis) in man.

The disease due to *Brucella abortus* is very similar to Malta fever (due to *Brucella melitensis*). It is usually contracted from close contact with cattle and hence occurs chiefly in farmers, veterinarians, cattle

buyers and other people closely associated with cattle. There is also the possibility of infection occurring through drinking unpasteurized milk from infected herds. The risk in this latter regard is greatly heightened in those rare cases where cattle become infected with *Brucella suis*.

The disease in humans may be serious, especially as treatment is reported to present some difficulty.

Cases of undulant fever have not been common in Australia up to the present time, but there can be no certainty that this state of affairs will continue. They are in fact now being recognised somewhat more frequently.

It is clear that brucellosis in cattle has features which are of interest to the community as a whole as well as to the owner of the affected cattle.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 18th OCTOBER, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
A.I.S.	F. B. Sullivan, "Fermagh," Pittsworth D. Sullivan, Rossvale, *via* Pittsworth W. Henschell, Yarranlea Con. O'Sullivan, "Navillus Stud," Greenmount H. V. Littleton, "Wongalee Stud," Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Kingaroy
Ayrshire	L. Holmes, "Benceoula," Yarranlea
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman J. F. Dudley, Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, *via* Rosewood J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount J. F. Lau, "Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Childers Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan

APPLIED BOTANY

Hemlock Declared a Noxious Weed.

S. L. EVERIST, Botanist, Science Branch.

HEMLOCK or poison hemlock (*Conium maculatum*) has been declared noxious throughout the State. The following notes are issued to enable those interested to identify this plant.

Description.

Erect annual or biennial herb 3-5 ft. high, with a strong mousy smell when crushed; root white, parsnip-like; stems stout, hollow, shining green outside, often with purple spots or patches, repeatedly branched; leaves alternate, sometimes opposite on upper part of stems, 4-12 inches long, deeply divided into narrow segments like a carrot leaf; smaller and less divided near top of plant; flowers very small, white, in clusters (umbels) at the ends of stiff, slender rays $\frac{3}{4}$-1 inch long; rays 8-15 in number, spreading out from the top of a stalk 1-2 inches long; 5 small green bracts beneath the ray clusters; fruits (''seeds'') numerous, about one-sixth of an inch long, nearly globular but somewhat flattened with thick ribs.

Distribution.

Hemlock is a native of Europe and Asia, now naturalised in most temperate regions of the world. It is common in parts of New South Wales, Victoria and South Australia. In Queensland it is sometimes grown in gardens under the name ''carrot fern'' and in appearance resembles the ''meadow sweet'' or ''bishop's weed.'' Lately it has become plentiful in a few localities in southern Queensland, and in every case the source of infestation has been traced to plants thrown out from gardens.

Seasonal Occurrence.

In Queensland, the plant makes its best growth in seasons with wet winter and spring months. It comes up in autumn or winter and persists through the spring until the beginning of summer. Seeds are usually produced between August and November.

Poisonous Properties.

For many centuries, hemlock has been known to be poisonous to man. Cases are on record of poisoning in cattle, horses, sheep, pigs and goats. It causes gradual weakening of muscular power and paralysis of the lungs, sometimes with loss of eyesight. All parts of the plant are poisonous. In Europe, the leaves and stems are reputed to be most dangerous before flowering and the young fruits to be very poisonous.

Plate 197
Drawing of Various Parts of the Hemlock Plant.

In man, cases of poisoning have occurred when seeds have been used in mistake for aniseed, and the roots for parsnips. There are even cases on record where people have been poisoned by blowing whistles made from the hollow stems.

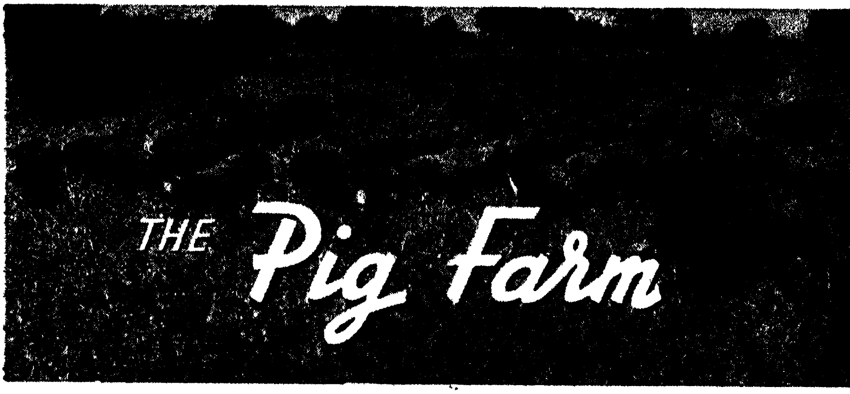
Because of its strong mousy odour, the plant is distasteful to most animals. Recently there have been cases where cattle have died after eating the young plants mixed with grass.

Plate 198.
A Single Plant of Hemlock.

Eradication.

Experiments conducted by the Department of Public Lands show that the plant can be destroyed by spraying thoroughly with hormone weedkillers. Young plants can be destroyed with 0·1 per cent. solutions and older plants with solutions double that strength. To get a 0·1 per cent. solution, 1 gallon of a liquid preparation containing 10 per cent. active ingredient should be added to 100 gallons of water. If the liquid preparation contains 50 per cent. active ingredient, 1 gallon should be mixed with 500 gallons water. With powders, 1 lb. should be added to 70 gallons water where the original preparation contains 70 per cent. of active ingredient, 1 lb. to 80 gallons where the powder contains 80 per cent. active ingredient, and so on. The percentage of active ingredient is given on the label.

To make a 0·2 per cent. solution, use half the amount of water.



Bacon Curing on the Farm.

F. Bostock, Officer in Charge, Pig Branch.

BACON curing on the farm is entirely different from factory curing and the following notes are designed for the guidance of farmers situated where there is no factory to which pigs may be sent to be cured. The home product, provided it is properly handled and the necessary attention given to important details, can be just as satisfactory as any the farmer can buy.

On the farm, curing should be conducted during the winter months, during frosty weather and in a moist atmosphere, as in a cellar, rather than in a dry atmosphere. Extremes of temperature are unfavourable.

The pigs selected for slaughter should be free from disease and in a healthy condition, gaining and not losing weight. They should be properly finished and free from bruises, cuts, sun-scald, etc. The live-weight should be about 175 lb. at approximately six months old, giving a dressed weight of about 125 lb., which is a desirable weight to produce first-class bacon. Some prefer pigs of much heavier weights for farm use, but excessively fat carcasses are not desirable.

The breeding of animals plays an important part in producing suitable carcasses, and the use of purebred sires of outstanding type and quality is necessary to produce ideal bacon pigs (Plate 199). Selection, careful handling, and intelligent feeding are also necessary.

PRE-SLAUGHTER CARE.

As with other animals, pigs should be kept off their food for about 24 hours before slaughter and allowed all the water they will drink. Should an animal be particularly restless, it is desirable to allow a small quantity of food. A well rested and fasted animal will give a better carcass, as the muscle is in good condition and the blood stream will not be gorged with nutrient substances from the digestive system. It is also claimed that the intestinal wall of a fatigued animal is less resistant to the passage of bacteria. In ordinary circumstances, most of the contamination that takes place at slaughter is of intestinal origin, and for this reason the intestinal content should be reduced to a minimum. Careful handling of the pig prior to slaughter is essential to the production of good bacon.

Plate 199.

Baconer Pig of Correct Type.

SLAUGHTERING.

Every care should be taken to avoid excitement and bruising at slaughter. Ordinarily, it is not necessary to stun or shoot the pig before sticking; although it is sometimes done, this method may not give the best results in bleeding. More thorough bleeding is assured if the pig is hung up by the hind leg for sticking, but care must be taken that the pig is held properly so that bruising or shoulder sticking does not occur.

Blood provides an ideal medium for the growth and multiplication of putrefactive organisms and it supplies a vehicle for their distribution throughout the animal. Thorough bleeding therefore has a profound influence on the keeping quality of a carcass.

Sticking without stunning, which is the common commercial practice, is not considered to be more cruel than other methods. However, for the beginner it may be a wise practice to stun the pig and get it into the proper position for sticking. This is on its back, and the man holding should stand astride the pig with feet against the shoulders, and take a firm hold of the front legs.

The man doing the sticking takes a position squarely in front of the pig, holds down the snout and opens the skin for a distance of about three inches in front of the breast bone. He then inserts the knife, edge upwards, taking a line with the base of the tail, for about four or five inches, lowers the wrist, which brings the point of the knife upwards, and withdraws the knife.

Care should be taken to hold the pig squarely on its back and to keep the knife in the centre so as not to stick the shoulder. It is both difficult and unwise to stick the heart. Let it pump out the blood as long as possible.

SCALDING AND DEHAIRING.

Soon after sticking, the pig is ready for scalding, in either a barrel or a tub large enough for the purpose. The temperature of the water for a pig of about 175 lb. liveweight should be 140° to 145° F., or approximately two parts of boiling water to one of cold. The work should be carried out in a sheltered place, as weather conditions will affect the scald. A slow scald is better and much safer than a quick scald. While in the water, the pig may be held by a hook through the snout, and the carcass should be kept moving, so that all parts get a uniform scald and a clean white skin is produced.

After the pig has been lifted from the scald and placed on a bench or table, scraping must be done as quickly as possible, as the hair will again adhere if allowed to cool. All tools necessary should be on hand before a start is made. The hind legs should be firmly grasped with both hands and the hair twisted off; the forelegs are treated in similar manner; then the dew claws and hoofs pulled off with a hook and the hair scraped from the body. After scraping, the carcass is washed down with cold water and gone over again, using a sharp knife, to see that all hair that may have been missed in the scalding is removed.

DRESSING.

There are many variations of dressing methods employed, but the following outline indicates the general procedure.

The tendons of the hind legs should be exposed by making a cut down the trotter between the foot and the hock. The gambrel is inserted in each leg and the carcass hung ready for dressing.

Stand at the back of the carcass and grasp the tail, then cut around the pelvic arch to loosen the bung, care being taken to keep the point of the knife against the pelvic bones.

With the belly facing the operator, make a shallow cut from between the back legs to the throat; cut deep to the bone between the back legs and open the abdominal cavity, care being taken not to puncture the bladder; insert the left hand and keep back the intestines and stomach and continue the cut through to the breast bone; the knife may be pointed downwards and inserted into the chest cavity in order to continue the cut through the centre of the breast bone and throat.

Now pull the bung through the pelvic cavity and ease the intestines down by severing the attachments to the backbone; cut around the skirt or diaphragm and pull out the lungs and heart; cut through just below the gullet.

The carcass is then thoroughly washed both inside and out, a short stick being inserted to keep the ribs apart, while a stone or potato is placed in the mouth to keep it open to allow drainage and more rapid cooling. To assist in cooling, the carcass may be backed down while hot—that is, cut into the backbone from the butt of the tail to the head. The kidneys and leaf fat are also removed and the carcass left neat and trim, then allowed to cool thoroughly.

Before proceeding further all animal heat must have left the carcass.

Cleanliness in all these operations is of the utmost importance.

INSPECTION OF CARCASS.

Although legal requirements apply only where meat is offered for sale or intended for sale for human consumption, it is strongly recommended that the carcasses of pigs killed for farm consumption be examined, if possible, by a qualified meat inspector to ensure that they are fit for human consumption. However, this may not be possible, and it is desirable that the person handling such products should be familiar with the normal and healthy tissues. This knowledge can only be acquired by experience and observation, but the following brief outline may prove a guide to the main points to look for.

The lymphatic system ramifies throughout the body somewhat like veins, and at intervals there are enlargements which are termed lymphatic glands, sometimes referred to by butchers as "kernels." They can be considered as filters which serve to prevent bacteria, etc., from penetrating further into the animal body. Most people are familiar with a swollen gland under the armpit arising from a poisoned hand, or sore throat causing an enlargement of the glands in the neck. Thus the meat inspector can usually find evidence of disease in an enlarged, discoloured gland more easily than in the tissues which have been primarily infected. A knowledge of the position and normal appearance of these glands is therefore of utmost importance in meat inspection.

Their size varies considerably, some of the glands being as small as a millet seed while others may be as large as a walnut. The outer wall of the gland consists of a strong fibrous coat, and in the gland proper two regions can be recognised—an inner portion somewhat pink in colour, and a lighter outer part. Some glands, particularly those to be found in the intestinal organs, may have a somewhat greyish colour.

As mentioned, glands act as filters to remove germs from the general circulation; they are, however, very sensitive and are found to be inflamed should there be inflammation in the region they drain.

In the case of tuberculosis, the changes that take place in infected glands (the most important of which are the submaxillary and cervical in the neck, and the precrural in the flank) may be observed in one of the following forms:—(1) swelling; (2) small cloudy spots; (3) formation of larger tubercles; (4) caseation (cheesy formation); (5) calcification (gritty formation). In the pig, tuberculosis is generally contracted by ingestion, and consequently the digestive system and its glands will usually be involved. Should the disease become generalized, the lungs, liver, spleen, and kidneys are usually affected.

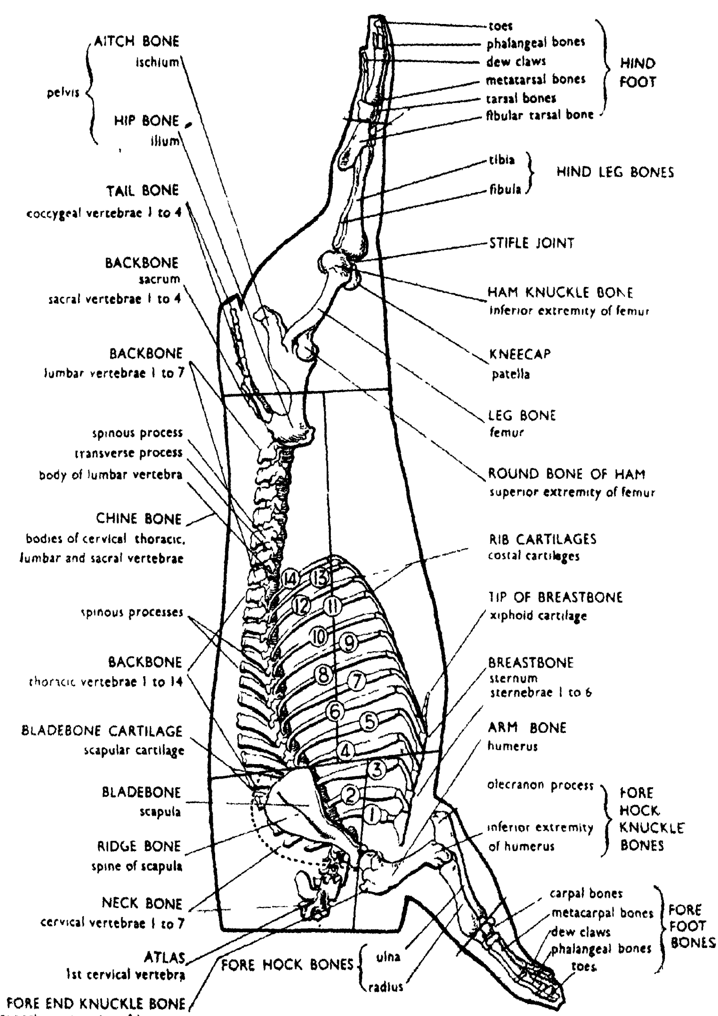


Plate 200.

Location of Bones and Cuts in a Side.

(From a Bulletin of the Ministry of Agriculture and Fisheries.)

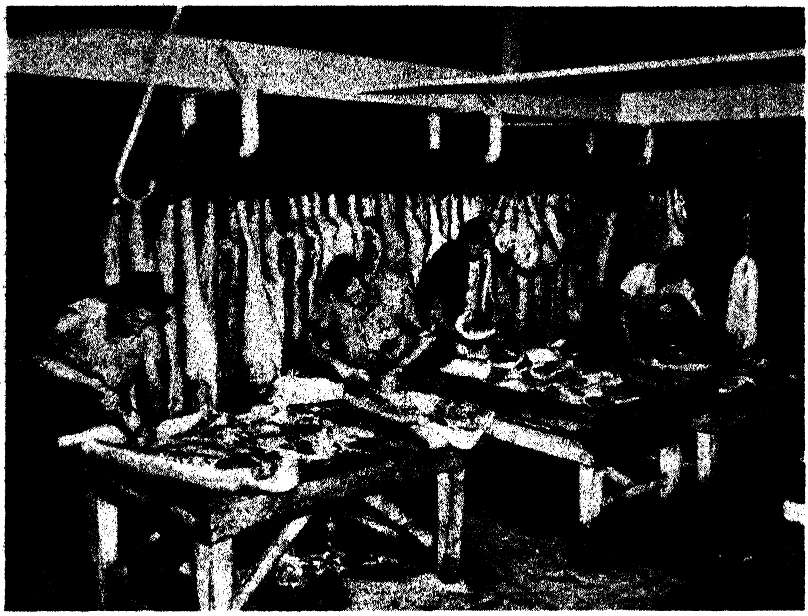


Plate 201.
A Cutting Room in a Bacon Factory.

Plate 202.
Side Divided into Shoulder, Middle, and Ham.
(From a Leaflet of the New South Wales Department of Agriculture.)

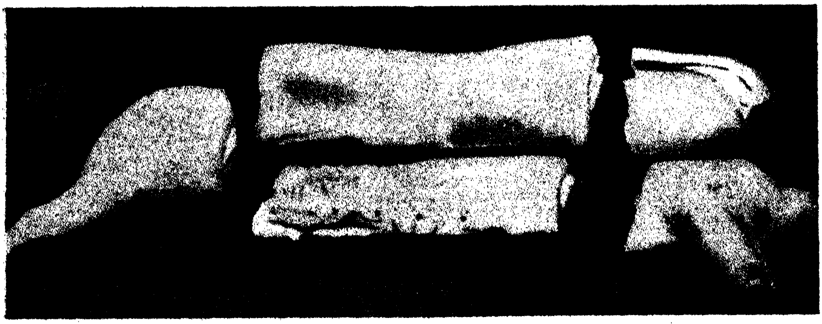


Plate 203.
Right Side as Cut to a Standard English Method.
(From a Bulletin of the Ministry of Agriculture and Fisheries.)

CUTTING UP.

There are various methods of cutting up, but a good plan is to remove the head and front feet, then split the carcass down the centre of the backbone, making two full sides. The backbone is then taken out in two pieces, and used with other trimmings for the making of pies, &c. Each side is now divided into shoulder, middle and ham; or the full side may be cured; or again the ham may be taken off, leaving the shoulders and middle together (called the flitch).

All parts are neatly trimmed and any scrap pieces taken off. A sharp pointed knife is used to release the joint oil in the ham and shoulder joints. Strong string is put in convenient places on the hams, flitches, &c., to enable the pieces to be easily handled and hung up.

CURING.

The curing of bacon should be conducted in a somewhat moist atmosphere with a regular temperature of from 40° to 45° F.—or during winter weather on farms. The curing room should be perfectly clean and as far removed as possible from any source of contamination, such as drains, heaps of manure, rubbish, dust, &c. There should be efficient ventilation, so that the carcass or pieces may be exposed only to pure air, and the floor of the room must be such (concrete for preference) that it can be readily cleaned.

Curing may take the form of dry salting or pickling, or a combination of the two methods, although for the farmer dry salting is the more convenient, and possibly less troublesome. The carcass must be thoroughly cooled and drained of blood before any attempt is made to cure the meat, otherwise it may decompose in parts and give objectionable flavours or taints.

Combined Method of Pickling and Dry Curing.

Although the dry cure method later described is recommended for farm use, there are numerous pickling mixtures to select from, as used in bacon factories, where the brine is tested by means of a salinometer and is used at a standard density of 95°, but the following formula will be found useful. For each pound of meat use—

Water	1/14 gal.
Salt (lb.)	No. of gallons of water × 3·2
Sugar (lb.) ..	1/10 of salt
Saltpetre (lb.) ..	1/10 of salt
Flavouring—allspice (lb.)	1/10 of saltpetre

Therefore pickle or brine for 280 lb. of meat would be—

Water	20 gal.
Salt	64 lb.
Sugar	6·4 lb.
Saltpetre	6.4 lb.
Flavouring (allspice)	0.64 lb.

Should saltpetre not be available, 7·5 lb. sodium nitrate could be used.

Always use the best brands of ingredients, and dissolve them through cheesecloth or a fine sieve. The use of sugar in a pickle or brine is a matter for the discretion of the curer; it may cause slime or set up a fermentation and not produce the mild flavour anticipated. The meat should be placed in a tub or cask, flesh side up, and care taken that it is well covered with brine.

The meat is left in the brine from four to six days, and then removed, salted, and stacked on a table or bench flesh side up for seven days. Use approximately 1½ lb. of salt per side. The pieces are then re-salted, using ¾ to 1 lb. per side, and if desired 10% sugar added. They are then stacked for a further seven days flesh side up. The changing of the stacking at seven days is to reverse the pieces in order to get an even distribution of the curing mixture. The pieces are soaked for 8 to 12 hours in clean water, which is drained off, and then washed in clean water at about 110° F. When the pieces are clean, they are hung up to dry. If possible, this should be done in the smoke house at a temperature of 85° to 90° F.; proper drying will take from 8 to 10 hours, after which they may be smoked (taking approximately 12 to 14 hours depending on the colour desired, usually a light tan), then rubbed lightly with olive oil after smoking.

Pickling.

If pickling only is desired, the following recipes are suggested:—

(1) For 125 lb. of meat.

Water	15 gal.
Salt	50 lb.
Saltpetre	1½ lb. (or 2lb. sodium nitrate)

The meat is placed in a cask and well covered with the pickle. It remains in the cask for 21 days, and is then taken out, washed, dried, and smoked.

(2) For 500 lb. of meat.

Clean rain water	20 gal.
Fine dairy salt	50 lb.
Brown sugar	5 lb.
Saltpetre	2 lb.
Allspice	½ lb.

Dissolve the salt, sugar and saltpetre in the water and immerse the allspice, tied in a calico bag. Boil for one hour and skim off any frothy matter rising to the surface while boiling. Allow the solution to come down to the temperature of the curing room before placing in the pickling tub.

The meat should be rubbed with salt and stacked for two days before being immersed in the pickle. If it is necessary to place weights on the meat in order to keep it immersed, see that clean pieces of hardwood are used, and soak them well in waste pickle before use. The time the meat is in pickle will be determined by the size of the pieces, but is usually three weeks.

Dry Curing.

When dry curing is practised, as is usually the case on farms to save possible trouble with brine, there are many different curing mixtures that may be used, but the following, using the best brands of salt, sugar and saltpetre available, will give good results.

For every 125 lb. of meat, use—

9 lb. salt
5 lb. sugar
¼ lb. ground allspice
½ lb. ground saltpetre or sodium nitrate.

After the carcass has been cut and trimmed into the desired pieces and the joint oil has been released from the ham and shoulder joints with a sharp pointed knife, the pieces are placed flesh side up and sprinkled with two parts of salt to one part of saltpetre (finely ground) or sodium nitrate and allowed to stand for 24 hours; this will draw off the surface blood and help retain the colour of the meat. The pieces are then turned and allowed to drain before applying the curing mixture.

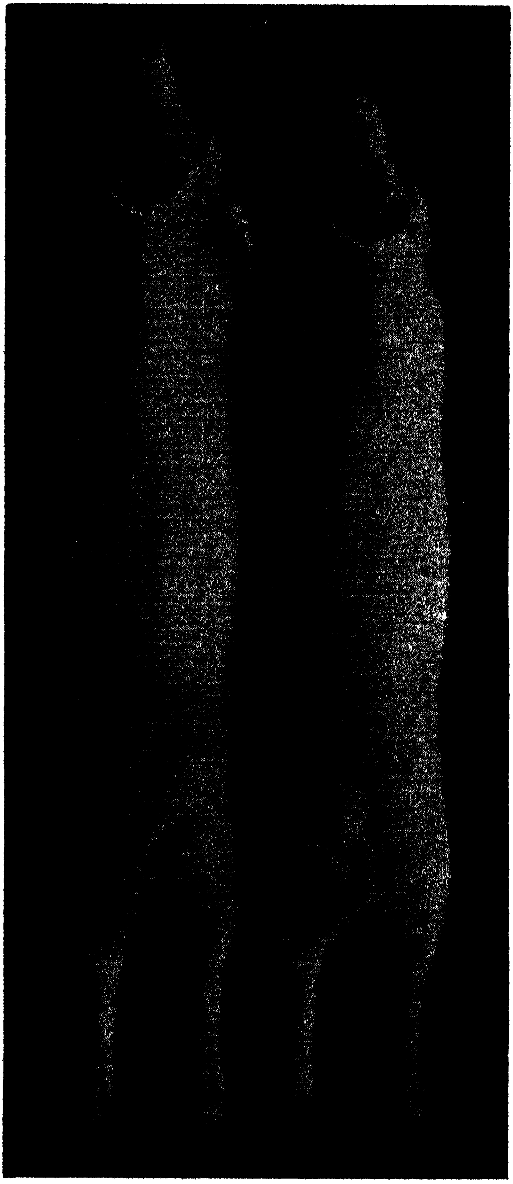


Plate 204.

Comparison in Carcass Length.

Curing by this method takes approximately three to four weeks according to the size of the pieces. The pieces are placed on a clean table or concrete floor, flesh side up, for the application of the mixture, and are then stacked. They are re-stacked differently every second

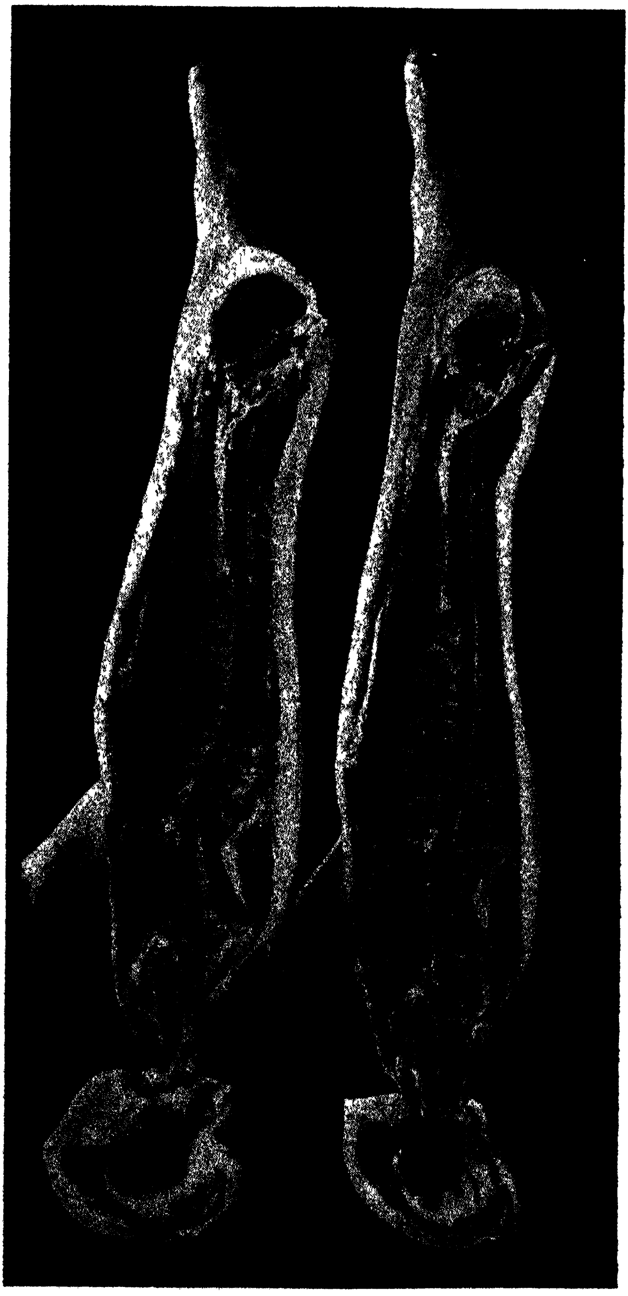


Plate 205.
Comparison of Fat Development.

day for two weeks, and then once a week for the balance of the time; the changing of the stacking is necessary to ensure an even distribution of the curing mixture. Extra salt should be placed along the bones and thick parts of hams and shoulders.

The pieces are next washed in water at a temperature between 100°F. and 110°F., dried, and smoked.

Much farm cured bacon becomes rancid through being hung in places where the temperature is variable, and bacon may be attacked by flies unless some preventive measures are taken. The pieces of bacon can be dusted over with pepper and then placed in a calico or flour bag, but should be kept in a dry place and examined periodically.

Smoking.

In addition to having a drying and preserving action on meat, smoking imparts a flavour which adds to the value of the bacon. It has been ascertained that in smoking bacon there is no loss of nutriment and the finished product is as digestible as fresh meat. The smoke has a distinct antiseptic or preservative action and provides a protecting cover which checks the action and growth of putrefactive organisms and their processes and retards decomposition. The effect of all is nullified if the meat has not been properly dried before being placed in the smoke house. The aim is to surround the bacon pieces with a dense smoke at a comparatively low temperature, which should never exceed 90°F. during the period of smoking.

Construction of a properly designed brick or iron smoke house may be worth while in some cases, but where a farmer only wishes to smoke one or two pigs at a time an old galvanised iron tank (say 600 or 800 gallons) would meet his requirements. The top of the tank is cut out, battens on which to hang the bacon pieces placed across the top, and the whole covered with bags or tarpaulin.

A well-spread sawdust fire about three inches deep is made in the bottom of the tank or smoke house. Many methods of creating smoke are applicable; sawdust (dried) with a few corncobs will answer to kindle the fire, with a good development of smoke without too much heat. Direct heat should be prevented from reaching any bacon that is hanging over the fire by having a sheet of galvanised iron placed on a column of loose bricks or stones. The smoke must be conveyed to the bacon cool, for if direct heat reaches the bacon the fat will melt and run and may cause loss of flavour, or fire.

Colour.

In deciding the length of time to leave the bacon in the smoke house, the colour desired must be considered. This is usually light brown or tan, and to obtain it smoking may occupy any period from one to two days. The character of the flesh, its thickness, &c., require to be estimated in order to obtain perfection in colour and flavour. When the desired colour is obtained, the tank should be uncovered or the door of the smoke house opened and the meat allowed to cool down before handling; from this time onwards the meat should be handled as little as possible, as the "bloom" may be rubbed off.

Smoked bacon will hang well in a smoke house until required, provided reasonable care is taken to exclude insects and keep the place very dry, dark and cool. Any degree of dampness or moisture in the atmosphere in which bacon hangs will result in the development of mould.

ASTRONOMICAL DATA FOR QUEENSLAND.

DECEMBER.

Supplied by W. J. Newell, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4.45	6.28	Cairns	51	7	Longreach	44	26
6	4.46	6.32	Charleville ..	39	24	Quilpie	33	37
11	4.47	6.35	Cloncurry	65	35	Rockhampton ..	19	0
16	4.49	6.38	Cunnamulla ..	27	32	Roma	19	15
21	4.51	6.41	Dirranbandi ..	16	22	Townsville ..	42	8
26	4.54	6.43	Emerald	28	11	Winton	52	29
31	4.56	6.46	Hughenden ..	49	21	Warwick	2	6

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	11.37	9.58
2	..	10.56
	a.m.	
3	12.09	11.55
		p.m.
4	12.40	12.54
5	1.11	1.56
6	1.45	3.01
7	2.23	4.11
8	3·07	5.24
9	3.59	6.38
10	5.00	7.47
11	6.08	8 49
12	7.19	9.41
13	8.29	10.24
14	9.34	11.00
15	10.35	11.32
16	11.33	..
	p.m.	a.m.
17	12.28	12.01
18	1.22	12.30
19	2.15	12.59
20	3.10	1.29
21	4.06	2.02
22	5.02	2.39
23	5.58	3 21
24	6.50	4.08
25	7.39	5.00
26	8.24	5.57
27	9.03	6.54
28	9.38	7·53
29	10.11	8.51
30	10.41	9.48
31	11.11	10.46

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	14	26	29	42	4	17	33	49
6	23	14	39	29	14	4	45	33
11	30	9	46	24	21	0	54	26
16	20	19	36	35	11	10	42	40
21	11	27	26	43	0	18	29	51
26	10	30	26	45	0	21	28	53
31	19	19	35	36	10	10	41	41

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	16	45	41	60	26	46	14	37
3	20	35	44	55	29	40	18	30
5	32	24	52	46	36	31	26	21
7	43	10	60	37	45	23	36	10
9	54	2	67	32	51	17	44	3
11	56	3	68	32	52	18	46	4
13	48	12	63	38	48	24	40	12
15	38	23	56	45	41	30	32	20
17	27	29	49	50	33	35	23	25
19	17	38	41	57	26	42	15	33
21	8	48	36	62	21	48	8	40
23	2	55	33	67	17	52	3	45
25	3	56	34	67	18	53	4	46
27	10	51	37	64	22	50	9	43
29	20	41	43	58	28	44	17	35
31	30	31	51	51	35	36	25	26

Phases of the Moon.—Last Quarter, 3rd December, 2.22 a.m.; New Moon, 9th December, 7.28 p.m.; First Quarter, 16th December, 3.56 p.m.; Full Moon, 24th December, 8.23 p.m.

On 22nd December at 8 p.m. the Sun will reach its greatest angle south of the Equator and will then rise about 25 degrees south of true east and true west respectively. On 4th, 17th and 31st December the Moon will rise approximately at true east and set close to true west.

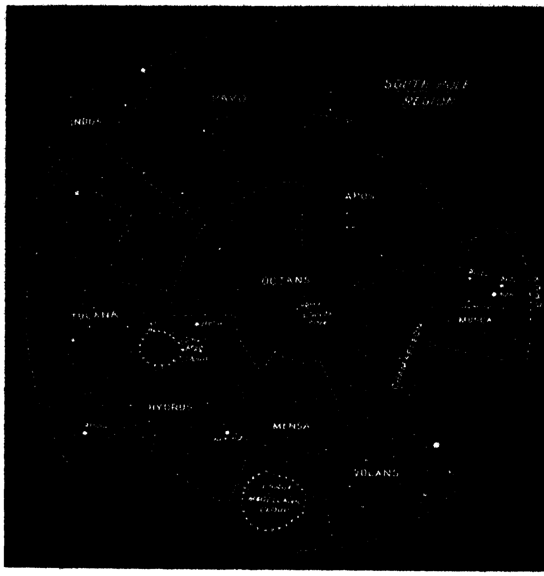
Mercury.—An evening object all this month, setting 1 hour 15 minutes after the Sun on the 1st, when it will be in the constellation of Ophiuchus. On 15th December it will reach an angle of 20 degrees east of the Sun, when it will set 1 hour 20 minutes after sunset, and by the end of the month, in the constellation of Sagittarius, it will set only 10 minutes after the Sun.

Venus.—Too close to the Sun for observation at the beginning of the month, but may be observed low in the west at sunset at the end of the month, when it will set about one hour after the Sun.

Mars.—At the beginning of the month, in the constellation of Sagittarius, will set between 9.15 p.m. and 10.30 p.m., while at the end of the month, in the constellation of Capricornus, will set between 8.55 p.m. and 10.15 p.m.

Jupiter—The dominating object of the evening sky now, is almost overhead at nightfall at the beginning of the month, when it will set about midnight. By the end of December it will set between 10 p.m. and 11.15 p.m.

Saturn.—Will rise just after midnight at the beginning of the month and by the end of the month will rise just before midnight. On the morning of 1st January the Moon will pass close to Saturn.



THE CONSTELLATIONS.

SOUTH POLE REGIONS.

The grouping of constellations in this area of the sky is of comparatively recent date—within the last 300 years or so—and these did not receive names at the same time as groups in the more northern areas because these stars never rose above the horizons of early areas of civilisation, which were situated north of the Equator.

The constellation surrounding the South Celestial Pole is Octans, named by Hadley. It is rather an inconspicuous group and unlike the constellation surrounding the North Pole, none of its stars are bright enough to be used as a guide, as is the Pole Star of the Northern Hemisphere, though two of its stars (Sigma, a fifth magnitude star, just out of the range of normal vision, and another star of seventh magnitude) are very much closer to the Pole than the North Pole star.

The constellations adjoining Octans are shown in the accompanying diagram. These include:—*Hydrus*, the Water Snake, which is on the meridian about 8 p.m. towards the end of December. Beta, a 2.9 magnitude star, is the nearest bright star to the South Pole and is 12 degrees away. There are three other serpents in the sky—Draco, near the North Pole, Hydra, and one held by Ophiuchus. The stars Alpha, Beta and Gamma are quite easily seen and form a large triangle.

Musca, a small constellation situated at the foot of the cross, Alpha, a third magnitude star, Beta, a double star, Gamma and Delta are all easily detected. The region around Alpha and Beta is very rich in small stars when viewed through field glasses.

Chamaeleon lies between Carina of Argo and the South Pole. It contains no stars greater than fourth magnitude, but they are a replica of the Little Bear of the Northern Hemisphere and the constellation was named The Little Dipper by early navigators and Chinese.

Pavo, The Peacock. The fourteen stars in the region representing the tail are as glorious as the bird's tail in real life.

Indus, The Indian, joins Pavo and is on the meridian about 8 p.m. in the middle of October, while Apus, The Bird of Paradise, is seen from April to November during the evening.

Toucanus, The American Goose, Volans, The Flying Fish, and Mensa, The Southern Fly, complete the circle around the South Pole.

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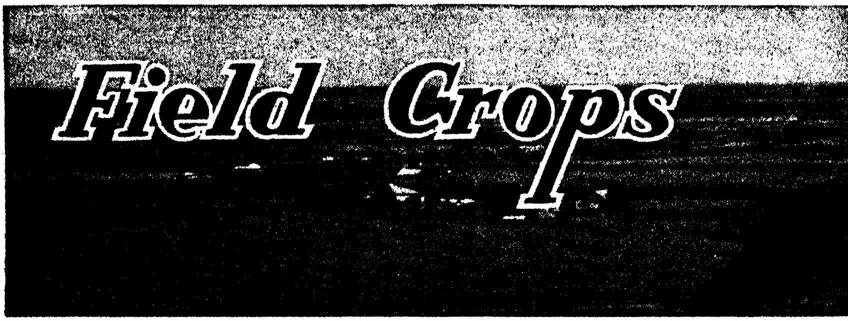


Queensland Certified Hybrid Maize.

Part 3. Summary of Rules.

F. B. COLEMAN, Standards Officer and Registrar, Seed Certification.

THE *Seeds Acts*, 1937 *to* 1941, provide machinery for the certification of seeds for sowing; a summary of the legislation, including regulations and rules, relating to the production of certified hybrid maize seed, follows.

General.

The purpose of certification of hybrid maize seed is to make provision for the production of seed for sowing of known purity of hybrid and freedom from specified diseases. To further this purpose, the Acts provide for the formation of a Committee which may regulate and control the planting, growing and harvesting of crops for the purpose of producing certified seed. The Committee is assisted by a Hybrid Maize Seed Certification Sub-committee.

The Committee has power to register an area of land for the growing of seed for certification and to approve or disapprove of the resultant crop. It may determine the procedure to be carried out in its production and, if satisfied as to the quality of the seed, authorise its certification.

As mentioned in Part 1, before being included in the seed certification scheme a hybrid must show, in official tests conducted by seed certification officers over a period of at least 3 years, an increase of not less than 15 per cent. in yield of grain over the better open-pollinated varieties, except where a hybrid merits its inclusion for a special purpose such as early maturity. The hybrid must also at least equal the average of the better open-pollinated varieties in resistance to lodging and disease. The Committee examines all performance records.

At present the following hybrids are eligible for certification:—Q23, Q431, Q462, Q467, Q499, Q629, Q658, Q692 (all of which are late maturing), and Q440, Q716, Q717, Q724, Q739, Q789, Q793, which are mid-season hybrids.

Probationary Grower.

Before a grower engages in the production of hybrid maize seed, he has to serve a probationary period of one season. He is required to sow, cultivate, detassel and harvest efficiently a crossing plot of approximately one-quarter of an acre and provide, without cost, not less than twelve ear samples from each parent.

In the next season, if he plants seed from his probationary plot, he uses only seed produced on the ear parent. Where a firm, partnership, company, association or other organisation desires to produce hybrid maize seed, it has to nominate a person to serve the period of probation; this person is then personally responsible for the production of hybrid maize seed by the organisation, and must be present as an active supervisor at all operations. Hybrid maize seed produced by a probationary grower will not be certified, and may not be sold or given away.

Any person who, under the supervision of a commercial grower, has been engaged in the duties necessary for the production of two crops of hybrid maize may with the approval of the Committee serve his probationary period on a portion of an area registered for the production of commercial hybrid maize and the product of such area may be sold.

More than one person associated with a producer may be nominated as a probationary grower, but each person must serve his probationship separately.

The number of probationary growers accepted for training may have at times to be limited to the number that can be handled effectively by the available Departmental staff.

Home Producer.

Any person who has served a satisfactory probationary period and desires to produce hybrid maize seed for his own sowing only is termed a home producer. He will normally be supplied with only enough seed to sow a half-acre crossing plot, but, in special circumstances, he may be granted a larger allocation. Hybrid maize produced by a home producer will not be certified and may neither be sold nor given away.

Commercial Producer.

Any person who has satisfactorily passed his period of probation and who produces certified hybrid maize seed for sale is termed a commercial producer.

Application for Registration of an Area.

An application form for the registration of an area for the growing of certified hybrid maize should, when completed, be forwarded to the nearest seed certification officer. However, an area of land will not be registered unless Departmental supervision can be adequately carried out and the crop satisfactorily grown. The closing date for the receipt of an application for the registration of an area under this scheme is 1st October.

Eligibility of Land.

Registration of land will be refused if it is infested with prohibited plants and/or diseases. It will be rejected also if it carried any maize during the previous season.

Isolation.

A crop will be rejected for purposes of certification if it is grown within 20 chains of any maize, other than the pollen parent, that is producing pollen while receptive silks are still present on the ear parent plants of the crossing plot. This includes the elimination of all volunteer maize plants within the area of isolation and consequently may involve some co-operation with neighbours.

Seed Origin and Treatment.

The seed used for sowing registered areas for the production of hybrid maize seed for certification will be supplied by the Committee through its agent, the Plant Breeder at the Agricultural College, Lawes.

The Committee has power to refuse to supply any grower with parent seed for the production of hybrid maize seed, in the event of a grower doing any of those things which he has contracted not to do. These include the sale of ear parent seed by a grower on probation or a home producer; the sale of seed from pollen rows as seed for sowing except as directed by the Committee; the harvesting for certification of ears from the pollen rows above a certain limit; continuing to detassel plants or process maize seed from a field that has been rejected; removal of seed from a grower's premises before it has been certified; and sale or distribution for sowing of any seed from a crossing field that has been rejected for certification.

Notice Required from Growers.

A grower is required to give to the seed certification officer supervising his crop not less than four days notice before flowering is anticipated and before he intends to harvest, shell, thresh, clean, machine-dress or pack.

Inspections.

Inspections are made by seed certification officers before registration, approximately six weeks after the planting of the crossing plot, and at least twice during the flowering period.

An inspector or seed certification officer has power to enter and inspect any area for which an application for registration has been made; he may make a plan of the area to be sown and the surrounding land, and inspect any area which has been registered for the purpose of producing certified seed. He may also inspect the crop and all operations connected with the production of certified seed, remove for examination or analysis any samples of any plants or parts thereof, and have removed and destroyed all plants which may render the crop ineligible for certification.

Crop Rejection.

A crop will be rejected for certification if it does not satisfy all the requirements laid down, or if all plants showing undesirable varietal characteristics have not been rogued out. If weed growth prevents the inspecting officer from making a thorough inspection of the crop, or is likely to impair the quality and/or purity of the seed, the crop will also be rejected.

Where the incidence of disease exceeds the tolerance laid down for any specified disease, or would adversely affect the yield or quality of the seed, the crop is rejected for certification.

Where cultural and fertilizer practices and pest and disease control have not been carried out in accordance with instructions, and plants removed for reasons of disease incidence are not treated as directed, the crop will also be rejected.

Where severe lodging and tangling, due to storm, straying stock or any other cause, render it impossible to identify different parents in any portion of the area, the seed certification officer may order the

grower to cut and remove all plants in such portion, so that the remainder of the crop may be certified if all other matters are in order. In all other cases rejection will apply to all of the area registered.

A crop is rejected for purposes of certification if all tassels on the ear plants have not been removed daily. This is done preferably during the morning, before they have begun to shed pollen. If more than one per cent. of tassels on the ear plants are shedding pollen at any one inspection, or more than two per cent. for all inspections, the crop is rejected. Each sucker tassel on the ear plants shedding pollen counts as one tassel and each incomplete tassel on the ear plants, part of which has been removed, if shedding pollen counts as one-half of one tassel.

The number of ear plants that have pollinated is ascertained by counting 20 stalks per row in five seed rows, moving in a diagonal direction from row to row until 100 plants have been counted. Five separate counts of 100 plants are made, each covering approximately one-fifth of the field.

Pollen parent plants must be sown in separate rows from the ear parent plants in crossing fields, and at least two border rows of the pollen parent are to be grown on each side of the crossing plot, otherwise the crop will be rejected. Pollen rows, including border rows, must be distinctly marked at both ends of the field.

Rejection will also result when any off-type or doubtful plants have not been rogued before they shed pollen, or if the number of ears missing from the pollen rows exceeds ½ per cent. at the time of the field inspection immediately prior to shelling, but this does not apply when pollen rows and stray ears are harvested first.

Harvesting.

The harvesting, threshing, cleaning, treating, machine dressing and packing of the seed, wherever applicable, is carried out under the supervision of and to the satisfaction of an inspector or seed certification officer. Machines suitable for the purpose are those which can be effectively and rapidly cleaned.

All ears from the ear rows are harvested first, and all ears from the pollen rows and dropped ears left in the field until all bags containing seed from the ear rows have been sealed. Alternatively, all pollen rows and stray ears may be harvested first and isolated in accordance with the directions of the seed certification officer so that all possibility of mixing is eliminated.

All ears from the ear rows are culled, so as to ensure that any off-types and all kernels affected by disease and/or insect attack are rejected. Removal of butts and tips is not imperative.

Where shelling takes place, all other maize is either removed or sealed up. The sheller must be thoroughly cleaned, particular attention being paid to ensure the absence of other seeds. The bags are sewn and sealed as they come from the sheller. Temporary labels are used for identification purposes pending purity and germination tests.

Where it is necessary for the seed to be cleaned or machine dressed at a place other than on the property on which is was produced, the packages containing such seed are sealed by a seed certification officer prior to despatch. After arrival at their destination, the packages are opened and the seed cleaned or machine dressed, packed, sealed and

labelled under the supervision of an inspector or seed certification officer. The seed is not available for sale until the final labels are affixed by a seed certification officer.

All seed for certification has to be stored under approved conditions, and certified seed is packed only in clean, sound packages.

At all stages between harvesting and packaging, precautions are taken to avoid contamination likely to impair the purity of the seeds.

Where required, the grower sells seed maize from the pollen rows of crossing plots for use by the Committee at an agreed rate.

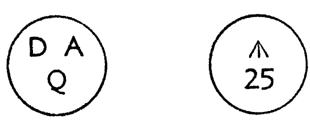
General Standard.

Before any seed is certified it must conform in all respects to the standards prescribed by *The Seeds Acts*, 1937 *to* 1941 (Queensland). The prescribed minimum germination is 80 per cent. However, notwithstanding the fact that the seed conforms to the standards prescribed by the Seeds Acts, such seed must be free from impurities which can be reasonably removed.

Identity of Certified Seed.

Every package of certified hybrid maize seed can be easily identified by the following:—

All packages are sealed with a lead seal impressed as follows*



All packages have attached to them a printed certification label which is supplied by the Department. The label shows:—

The hybrid;
Districts for which it is recommended;
Season grown;
Registered area number;
Sample number;
Date;
Signature of the seed certification officer.

Irrespective of origin, seed contained in open packages must not be sold or offered for sale as certified seed.

Sale of Certified Seed.

The Department of Agriculture and Stock does not undertake to arrange for the sale of certified seed.

The names and addresses of growers of certified hybrid maize are available on application to the Department of Agriculture and Stock or the Plant Breeder, Queensland Agricultural College, Lawes.

Costs.

The cost of field inspections required in hybrid maize seed certification is borne by the Department of Agriculture and Stock.

*The number identifies the seed certification officer.

VEGETABLE PRODUCTION

Cabbage, Cauliflower, and Related Crops.

R. L. PREST, Senior Adviser in Horticulture.

THE cruciferous crops are of considerable importance economically. Some of the cultivated species grown as vegetables in Queensland are cabbage, cauliflower, broccoli, kale, Brussels sprouts, Chinese cabbage and kohl-rabi. All require the same general treatment in the field. With the exception of kohl-rabi, which is sown direct in the field, the seedlings are usually raised in seed boxes or beds and later transplanted.

Seed-beds.

The seed should be sown in well-drained seed-beds with a deep and thoroughly worked soil. Seed-beds should only be moderately fertile, otherwise the young plants do not develop a good root system and are soft and difficult to transplant. If on the other hand the soil is very poor, a small quantity of fertilizer may be added to it about a week before sowing the seed.

After smoothing the surface with a rake, the bed should be firmed with a flat board, and the seed then sown thinly in shallow drills, not more than half an inch in depth and about four inches apart. After sowing the seed, the surface of the bed should be mulched with well-rotted leaf mould or old manure, or covered with bags, in order to retain the moisture in the soil and germinate the seed quickly and evenly. If bags are used, they should be removed immediately the young plants show above the ground.

The young seedlings germinate in three or four days in warm weather but take from two to three weeks during colder months. Approximately five to seven ounces of cabbage seed and four to six ounces of cauliflower seed provide enough plants for one acre.

Seed-beds should be watered regularly, otherwise the growth of the young seedlings will be checked. When large enough to handle, the seedlings may be thinned to about half an inch apart; if allowed to grow thickly they develop into long, spindly, weak plants.

If it is very hot during the middle of the day, shading may be necessary, but the covers should be removed as soon as the plants are strong enough to withstand the heat. Over-shading produces plants which are soft and difficult to transplant.

TRANSPLANTING.

In from three to six weeks, according to the time of the year, the young plants should be large enough for transplanting. About a day or two before transplanting, they should be hardened off by withholding water. Immediately before transplanting, however, the plants may be given a good watering as this will facilitate their removal from the seed-bed without excessive injury to the young rootlets. For preference, transplanting should be done during cloudy or showery weather. If weather conditions are unfavourable, the young seedlings should be watered in. As a further precaution, particularly if the plants are large, the top half of the leaves may be cut off to lessen transpiration until the new root system is firmly established. During transplanting, the roots of the young plants should be kept damp by standing them in a bucket containing a puddle of soil and water, or alternatively by keeping them in shallow trays which can be covered with wet bags.

In planting, a hole is first made in the ground with a small hoe or by hand, and this should be deep enough to allow the roots of the seedling to reach the bottom. A little earth is turned in and the plant then drawn slightly upwards before pressing the soil firmly around it. This ensures that the main root is not doubled up.

FERTILIZING.

The application of fertilizers ensures quick growth of cruciferous crops. There are a number of complete fertilizers on the market which have proved satisfactory.

A 5-12-5 or similar mixture containing a fair proportion of organic matter such as blood and bone is recommended as a basal dressing. The rate of application varies in different districts, and actually on different farms—each experienced grower has his own views on the matter—but 10 to 15 cwt. to the acre is a suitable dressing on most soils. The fertilizer is broadcast along the rows where seedlings will be planted later and scuffled in a week or more before transplanting.

About four to six weeks after field planting, a side dressing of from 8 to 10 cwt. to the acre of a quick-acting complete fertilizer with a formula somewhat similar to that used for the basal dressing may be given. At hearting, a dressing of 2 to 3 cwt. per acre of sulphate of ammonia or nitrate of soda is desirable.

Cruciferous crops should be grown quickly without any check in the field, and this demands regular cultivation, frequent watering in dry weather, and correct fertilizer usage.

The following table of approximately equivalent quantities of manures may be used by the small grower:—

Per Acre.	Per Sq. Perch.	Per Sq. Yard.
	lb.	oz.
1 ton	14	8
½ ton	7	4
5 cwt.	3½	2
4 cwt.	2¾	1½
3 cwt.	2	1
2 cwt.	1½	¾

CABBAGE.

Climatic and Soil Requirements.

The cabbage is a cool climate crop and makes its best development in those localities where it can grow to maturity under temperate conditions. In coastal Queensland, it is mainly a winter crop, but the season of production has been considerably extended by the introduction of suitable varieties.

In the cooler climate of the Granite Belt, cabbage is grown as a summer crop; in south-eastern and metropolitan areas near the coast (Plate 206) the crop is grown all the year with the exception of the hot summer months; in central and north Queensland the cropping period extends from late autumn to spring.

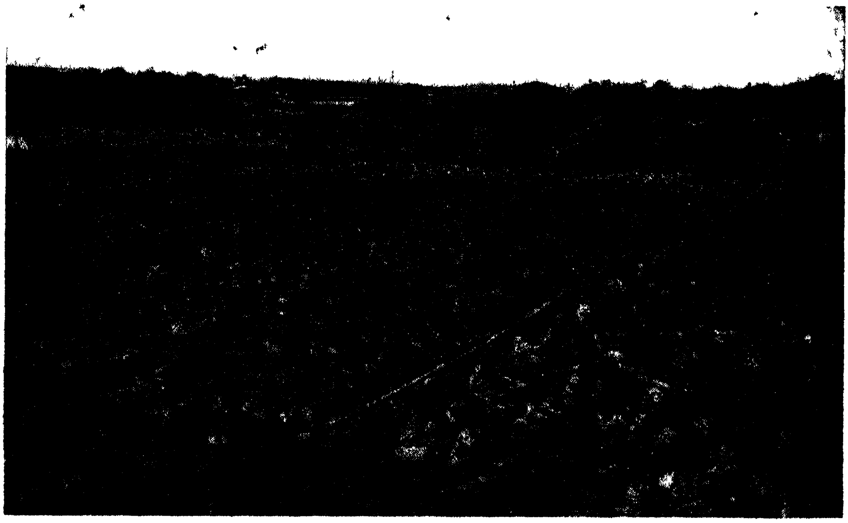


Plate 206.
A Field of Well-grown Cabbage at Redland Bay, near Brisbane. Note the overhead irrigation line.

Spacing.

Cabbages are transplanted to the field in rows not less than two feet six inches apart, the plants being one foot six inches or more apart in the row, depending on the variety used. In non-irrigated field crops, a wider spacing is sometimes desirable.

Varieties.

In coastal districts, early, quick maturing varieties are sown between January and April and the main crop varieties from May to June. In the cool temperate Stanthorpe area, seed may be sown from early spring to December. In central and north Queensland, seed planting may be done from February to July.

Recommended varieties are:—

Early.—Early All Head, Early Drumhead, Henderson's Succession, Mid Season Market, and Copenhagen Market.

Main Crop.—All Seasons, Select Succession, and Succession. For North Queensland: Henderson's Succession and Enkhuisen Glory.

Marketing.

Cabbage should be marketed as soon as practicable after hearting, and only good firm-hearted heads should leave the farm. Care in handling is essential. When placed in bags for railing at least some of the outside leaves should be left on the heads to protect the hearts from injury. The heads should be packed in the bags as firmly as possible.

CAULIFLOWERS.

Climatic and Soil Requirements.

The cauliflower is more exacting than the cabbage in its climatic requirements, and thrives best in areas where the later part of the growing period is cool and moist. Low temperatures during the early stages of growth may cause the plant to button or head prematurely, more particularly when varieties are grown out of season. Low humidity and wind are injurious. High temperatures during the heading period may make the curd yellow, "ricey," "fuzzy" or "leafy."

Spacing.

Cauliflowers require a good deal of room to develop. Formerly large varieties were grown extensively, but the market now prefers the small, high quality types. The large, late-maturing varieties such as Phenomenal should be spaced not less than three feet apart in the row with the rows four feet apart. Smaller varieties such as Early Snowball should not be less than three feet apart in the rows with the rows three feet six inches apart.

Plate 207.

An Irrigated Cauliflower Crop in Which Harvesting Has Begun.

Blanching.

From the button stage onwards, the plants should be examined every few days in order to determine when the crop is ready for cutting. During such inspections any curds which are exposed to the sun should be protected by breaking one or two central leaves and drawing them over the developing curd; otherwise some discolouration occurs. This precaution may not be needed in self-covering varieties.

Harvesting.

The curds do not develop uniformly in all plants, hence the crop must be examined daily during the cutting period, as over-mature heads do not sell well. The heads are cut, trimmed and carted to a central shed, where they are packed and loaded on to motor lorries for market. Jacket leaves are trimmed sufficiently long at the harvesting to give good protection en route to market.

Defects.

The longer the curds are left after they are ready for cutting, the sooner they wilt after harvesting. Open, spread or broken curds are frequently the result of late cutting.

"Riciness" is a curd characteristic when the crop matures during exceptionally dry weather. The curd has a granular appearance, and is less compact than it should be.

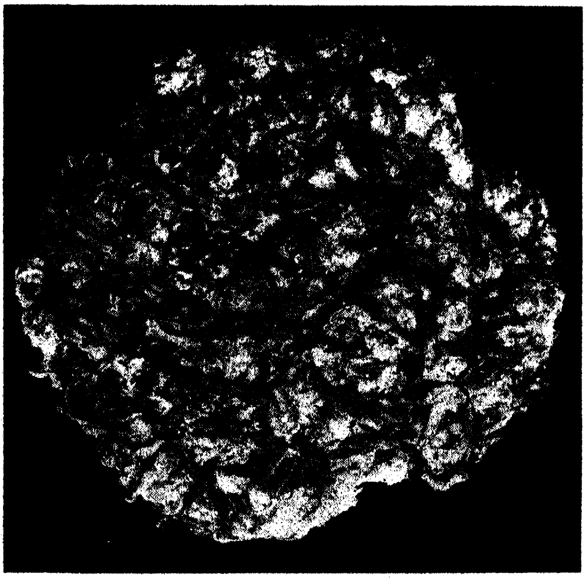
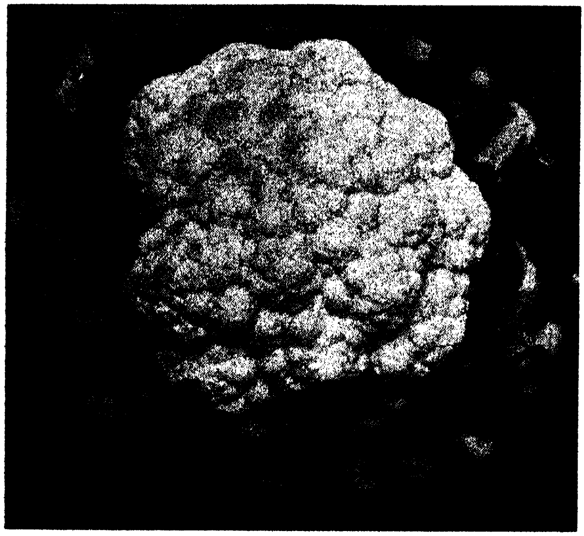


Plate 208.

An Off-type Cauliflower with Small Leaves in the Curd. This type often appears in crops grown from old seed, in out-of-season crops, and on soils deficient in molybdenum.

Some varieties are subject to "fuzziness"; the curd appears velvety or fuzzy. This defect is most prevalent when the crop is grown under unfavourable conditions. "Leafy curd" (Plate 208), a defect in which small, green leaves appear between the segments of the curd, is generally

attributed to poor seed, but the best strains may develop leafy curd if grown out of season when conditions have not been favourable. Leafy curd has also been described as one of the symptoms of whiptail, which is due to a molybdenum deficiency.



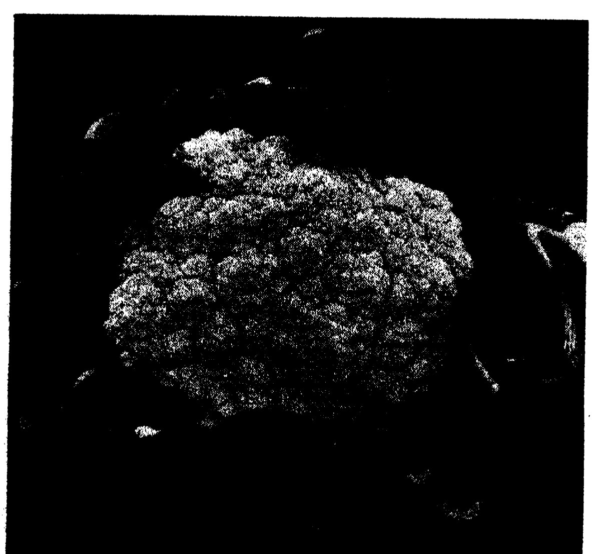


Plate 209.

Cauliflower Varieties. Top—A Snowball Type of Good Quality; Bottom—Early November, a Large Coarse Flowered Variety not Suitable for Queensland.

Varieties.

In the coastal districts, the seed of the early varieties is sown in the January-February period, and main crop varieties between March and May. In the Stanthorpe area, seed may be sown from October to December. Recommended varieties are:—

Early.—Early Snowball (Plate 209), White Queen, and Phenomenal Twelve Weeks.

Midseason.—Phenomenal Four Months and Hawkesbury Solid White.

Late.—Phenomenal Main Crop and Phenomenal Five Months.

BRUSSELS SPROUTS.

Brussels sprouts are somewhat exacting in their climatic requirements. They make their best development in a cool and equable climate. In Queensland, they are grown as an autumn crop, the seed being sown from November to January. The young sprouts reach perfection when hardened off by a sharp frost. The plants stand well with sprouts and under favourable conditions will carry through to September. They are a long season crop and hold the ground for five to six months.

Spacing.

Where irrigation is practised, the rows should not be less than three feet apart with two feet between plants in the row. Without irrigation, planting a little wider is recommended. Field planting after March is not recommended, as, if planted too late, very few sprouts are formed and the plants tend to run to seed.

Harvesting.

As the plants mature, the lower side leaves fade, and should be removed. The top growth should not be interfered with. It is necessary to keep the plants growing the side sprouts.

Sprouts are ready to harvest 12 to 14 weeks after planting out. Picking should be commenced from the bottom of the plant, before the sprouts begin to open, when they are in a hard, firm condition. They should be graded for size and quality and packed in half-bushel cases for the market.

Varieties.

The variety Champion has done well in southern Queensland.

BROCCOLI.

There are two types of broccoli—the sprouting and the heading type. The latter is similar to, though quite distinct from, the cauliflower and it is only grown in Queensland on a small scale.

The sprouting or non-heading type of broccoli is grown for the tender sprouts which arise from the axils of the upper leaves and from the terminal end of the main axis. These sprouts consist of immature green flower buds on a thick fleshy stalk.

Spacing.

The seed may be sown from January to March. When large enough to handle, the seedlings are planted out in rows two feet six inches apart with the plants one foot six inches apart in the rows.

Harvesting.

The growing period extends over a period of five months or more. The first pickings are usually made about four months after transplanting. The heads should be harvested before the curd commences to break, and cut with only one or two of the youngest leaves. Secondary heads develop and successive cuttings may be made over a period of six weeks or more.

Varieties.

Green Sprout is a favoured variety in southern Queensland.

CHINESE CABBAGE OR PE-TSAI.

Chinese cabbage is an annual of which there are two more or less distinct species, the Pe-tsai and the Pak-choi. The former resembles cos lettuce and forms an elongated compact head. The Pak-choi varieties resemble silver beet in their habit of growth; the leaves are long, shining dark green, oblong or oval. This type does not form a compact head.

The Pe-tsai varieties are favoured for small market gardens, and Pe-king and Pao-ting are considered the best varieties for the home garden.

Spacing.

Seed may be sown during July and August for the spring crop, and again during January and February for the autumn crop. The general practice is to sow the seed in shallow drills two feet apart, and later thin out the plants to about one foot apart in the row.

KALE OR BORECOLE.

The kale or borecole is distinguished mainly by its open habit of growth and does not form a heart. It is exceedingly variable in habit; plants may be tall to dwarf and the leaves are variously curled and dissected. Kale is chiefly an autumn, winter and early spring crop. While very hardy and able to withstand cold weather conditions, it does not tolerate hot weather.

Spacing.

Seed may be sown between January and March direct in shallow drills with rows two feet to two feet six inches apart. When established, the plants are thinned to one foot or one foot six inches apart in the rows.

Harvesting.

The first cuttings are made about four to five months after planting out. The loose leaves are used for cooking in the same way as cabbage; as soon as they are large enough they should be pulled from the bottom of the plants. Eventually the heads are taken. Plants from which the lower leaves were taken in the early winter will produce a crop of tender shoots in the spring.

Varieties.

A variety in favour with growers is Dwarf Green Curled. It is hardy and very tender when cooked.

KOHL-RABI.

The kohl-rabi, or as it is often termed, the turnip-rooted cabbage, is a vegetable combining the characteristics of the cabbage and turnip. The plant is a low growing biennial with small thin leaves. The stem is short and fleshy and the enlarged edible portion is entirely above ground.

Planting.

Kohl-rabi does not transplant readily. The seed may be sown at a depth of about half an inch during the late summer and early autumn in rows two feet apart. The plants are thinned out to eight inches apart in the rows later on.

Harvesting.

The bulbs should be ready for market in four to five months. They should be harvested when not more than four inches in diameter, as they become coarse and inferior when allowed to grow too large.

Varieties.

The large purple variety is most favoured by the home gardener because of its sweet flavour. The large green variety is, however, becoming popular; its flavour is much stronger than that of the large purple.

ANT PROTECTIO

The Importance of the Calyx Spray in the Codling Moth Control Programme.

A. W. S. MAY, Entomologist.

PRIOR to the use of DDT for the control of codling moth* in apples in the Stanthorpe District, mainly arsenate of lead and white oil were used in spray schedules. These materials were applied either separately or mixed, or the white oil was combined with nicotine sulphate. Normally, an arsenate of lead or an arsenate of lead-white oil spray was applied after petal fall but before the greater number of calyx cups had closed. This calyx spray has been regarded at Stanthorpe and in some other apple growing regions as an essential feature of codling moth control.

Since the advent of DDT the status of codling moth as a pest of apples in the Stanthorpe district has changed considerably. In recent years spring moth populations have been low (see Table 1) and where DDT cover sprays have been applied at approximately three-weekly intervals crop losses have been negligible. Extensive crop damage early in the season has decreased considerably in comparison with the seasons prior to 1947-48, when lead arsenate was in general use. The use of DDT, however, has raised other problems. In addition to the general increase of population of woolly aphis† and mites,‡ the costs of spraying necessary to control pests have risen steeply.

TABLE 1.

Season.	Calyx and Cover Sprays Used.	Number of Moths Trapped (10 Traps).					Spray Applications.	
		Oct. 17–23.	Oct. 24–30.	Nov. 1–6.	Nov. 7–13.	Nov. 14–20.	Calyx.	First Cover.
Orchard 2								
1945–46	Arsenate of lead ..	15	72	69	29	34	Oct. 19–23	Nov. 2–9
1946–47	Arsenate of lead ..	7	44	65	43	11	Oct. 12–19	Oct. 25-Nov. 2
1949–50	DDT	5	1	14	1	0	Oct. 20	Nov. 7–11
Orchard 3								
1949–50	DDT	..	1	..	..	..	Oct. 19	Nov. 7–11

* *Cydia pomonella* L. † *Eriosoma lanigorum* Hausm.
‡ *Tetranychus urticae* Koch and *Bryobia praetiosa* Koch.

Experiments carried out in the Stanthorpe district during the past two seasons have been concerned with determining the most effective usage of DDT cover sprays for codling moth control, and with the relationship between the amount of DDT applied in a season and the prevalence of other pests. While the possibility of reducing the number of DDT cover sprays without prejudicing codling moth control has been a feature of these investigations, the importance of the calyx spray when a suitable DDT cover spray schedule is adopted has been given attention. Trials covering this latter phase of the work during 1949-50 are reviewed here.

1949-50 CALYX SPRAY EXPERIMENTS.

Three similar experiments were commenced on Delicious apples in October. On two of the orchards DDT had been used during the previous season, thus reducing the likelihood of high spring moth populations. On the third orchard the 1948-49 crop was almost entirely destroyed by a severe last frost; only a few fruit matured on the trees and no sprays were applied.

Each orchardist applied routine DDT cover spray schedule to all experimental trees after the following calyx treatments:—

A. 0.1 per cent. DDT spray.

B. Combination spray containing 3 lb. arsenate of lead and 2½ pints of white oil in 100 gal. of water.

C. No spray.

Results.

At harvest, a sample of 100 fruit was picked from each tree and examined for codling moth infestation. The total crop per plot was also recorded. Table 2 summarises the results. (On orchards Nos. 1 and 3, five trees in each treatment were harvested, but on No. 2 only four were harvested.)

TABLE 2.

Calyx Treatment.	Orchard.	Total Crop (Loose Bushels).	Number of Fruit Examined.	Codling Moth Damage.		Percentage of Fruit Damaged.
				Blind Stings.	Wormy.	
DDT	1	18	500	7	..	
	2	21	400	6	1	
	3	16	500	..	..	
Totals ..		55	1,400	13	1	1·0
Arsenate of lead-white oil	1	13½	500	2	..	
	2	19	400	6	1	
	3	19	500	..	..	
Totals..		51½	1,400	8	1	0·6
No spray ..	1	12½	500	1	..	
	2	17	400	8	2	
	3	22	500	..	..	
Totals ..		51½	1,400	9	2	0·8

Discussion and Conclusions.

These results are a typical example of the excellent control obtained when a DDT cover spray schedule is used. The absence of large differences between treatments indicates that calyx sprays had no influence on codling moth control in these experiments. From observations, similar conditions exist on most orchards in the Stanthorpe district, but it should be remembered that the deletion of the calyx spray depends on spring moth populations remaining at a low level.

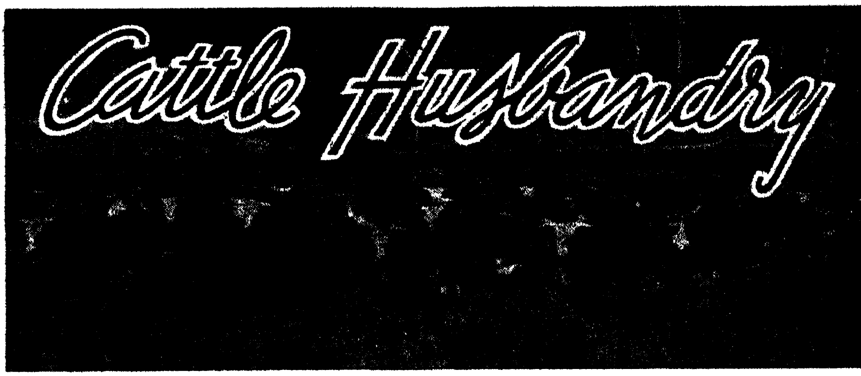
The presence of the pest during the previous autumn and the prevalence of overwintering larvae in trees should be used by the orchardist as a guide in deciding to apply a calyx spray. It is further suggested that lure traps be placed in the orchard in early October. This will provide a more definite indication of pest populations actually present, and will also help in determining the correct timing of the first codling moth cover spray, which should be applied within three weeks of petal fall..

Acknowledgements.

Sites for these experiments were readily provided by Messrs. Ellwood Bros., The Summit; J. Stringer, Applethorpe, and W. Townsend, Severnlea. Their assistance in this regard is appreciated.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 14th NOVEMBER, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas
A.I.S.	F. B. Sullivan, "Fermagh," Pittsworth D. Sullivan, Rossvale, *via* Pittsworth W. Henschell, Yarranlea Con. O'Sullivan, "Navillus Stud," Greenmount H. V. Littleton, "Wongalee Stud," Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Kingaroy
Ayrshire	L. Holmes, "Benrecula," Yarranlea
Friesian	C. H. Naumann, "Yarrabine Stud," Yarraman J. F. Dudley, Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, *via* Rosewood J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount J. F. Lau, "Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Childers Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan



An Automatic Feed Hopper.

R. W. HEWETSON (Cattle Husbandry Branch) and R. P. RUDDLE.*

LIMITED concentrate feeding of dairy cows in the bail has often been criticised by farmers because of the labour involved. Time lost in feeding is most important on farms where only one man is available to bail up, milk and feed upward of thirty cows on his own.

One of the authors was in this position about two years ago, faced with the prospect of milking and feeding up to sixty cows.

The automatic feed hopper described here and illustrated in Plates 210-213 was designed as an answer to the labour problem, and now sixty cows can be milked and fed in just over an hour.

Construction.

For most efficient working, a reservoir for feed that only need be filled, at the most, once a day should be provided. In the case of this hopper, the reservoir was made from a five gallon tin which had previously contained rolled oats. However, any suitable container, preferably made of metal, could be used.

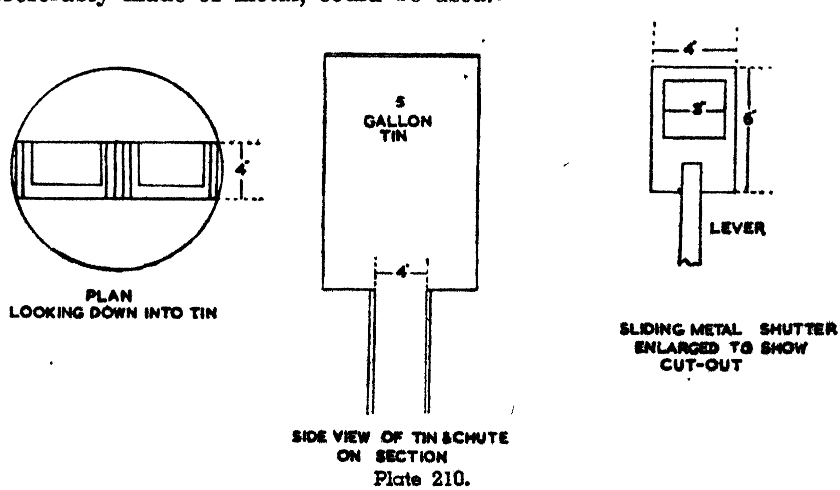


Plate 210.

Details of Reservoir and Cut-out.

* Mr. Ruddle is a Maleny dairy farmer who has devised or adopted many improved husbandry practices.

A strip 4 inches wide is removed from the bottom of the tin and the opening thus made placed over the entrances to the two chutes which run to adjoining feed boxes. The chutes and levers are for preference constructed of 1-inch pine.

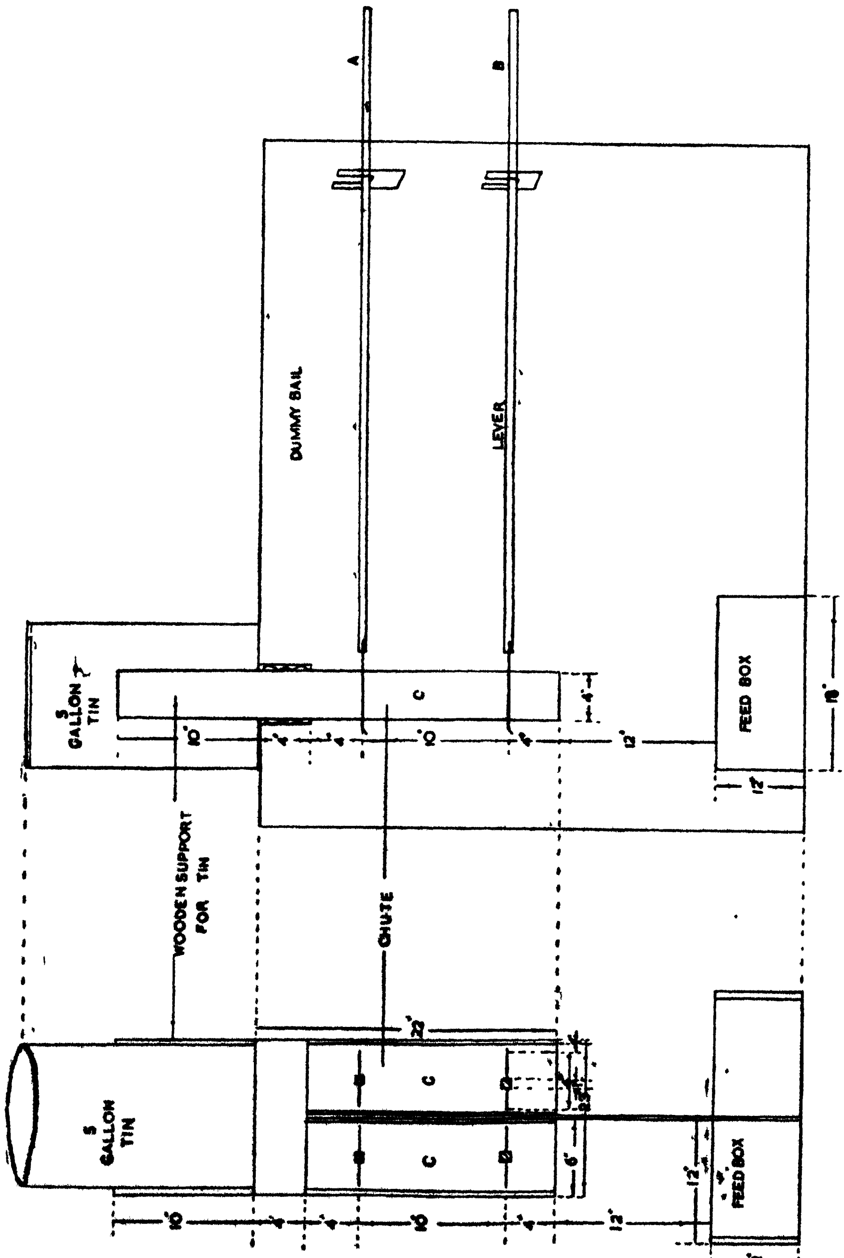


Plate 211.

Construction Details of Feed Hopper.

Four inches below the exit from the tin is a sliding metal plate. This can be opened or shut to allow or block the passage of feed down the chute, and this is remotely controlled by a 1 in. x 1 in. wooden lever (A in Plate 211), which can be manipulated from the end of the dummy bail. There is a second sliding plate ten inches below the first, which is manipulated by another lever (B in Plate 211). The space enclosed by the two plates was constructed to hold two pounds of meal. However, the quantity of feed to be delivered can be altered

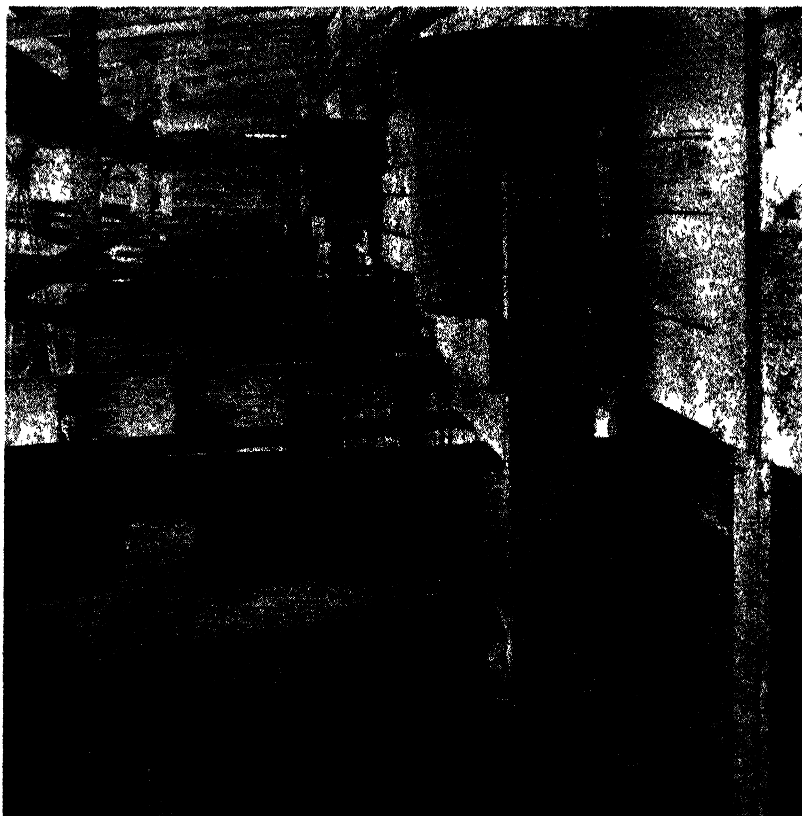


Plate 212

Position of Feed Hoppers in the Dairy Building.

by raising or lowering the position of the two plates so that the volume of the space between the two plates is increased or decreased. Of course, this is only a volumetric measure and the weight delivered would alter with the texture of the feed.

To measure out the given quantity of feed, lever A is pulled out to allow entrance of feed. When sufficient has entered the space, lever A is replaced in the closed position and lever B is pulled. This allows the measured quantity of feed to drop into the feed box. A double quantity can be delivered by repeating the procedure.

With this hopper, cows can be fed on a production basis rather than at a flat rate. If milk weighings were done, cows could be divided into high, medium and low producer groups and fed accordingly. There is no trouble with the flow of grain, even bran running smoothly down the chute.

The hopper described has been made to fit over the partition between two bails by leaving a slot between the two chutes. This allows for the removal of the whole structure for cleaning as often as is necessary, or for repair.

Plate 213.

Hopper Showing Reservoir Chutes and Feed Box.

ANIMAL HEALTH

Yellow-wood Poisoning of Livestock.

Prepared in the Division of Animal Industry.

FOR many years a condition of cattle, characterised by rapid wasting associated with blinking of the eyelids and a yellowish discharge from the inner corner of the eye, has occurred amongst herds depastured in the basin of the Fitzroy River.

The seriousness of the condition varies from district to district and from year to year. In dry years, losses may be as high as 10 per cent. of the stock on some properties, and in these circumstances the maintenance of herd numbers constitutes a serious problem.

Surveys made by botanists and veterinarians a few years ago revealed that the distribution of the condition was closely associated with the occurrence of a small tree, commonly known as yellow-wood, which constitutes heavy scrubs in some areas. It had previously been shown that yellow-wood was poisonous to sheep and that affected animals suffered severe fits when given a sudden fright.

It was decided, therefore, to conduct feeding trials with yellow-wood to determine if it was poisonous to cattle. It was found that young cattle which consumed yellow-wood leaves for two or three weeks exhibited symptoms identical with those which were apparent in animals affected under natural conditions.

The purpose of this article is to acquaint pastoralists with the appearance and distribution of yellow-wood and with the nature of the conditions it produces in stock.

APPEARANCE AND DISTRIBUTION OF YELLOW-WOOD.

Yellow-wood is a large shrub or small tree of rather dense growth (Plate 214). The leaves are from one to two inches long, of a light green colour, and commonly borne in clusters along the stems. The flowers are insignificant and are carried on small spikes. The seed capsule is dry and its sides are extended into broad wings (Plate 215).

The plant sends up suckers freely, and these tend to appear in groups around the base of the trunk. During the autumn and early winter, the leaves become distinctly red in colour and subsequently yellowish, when they fall. In dense yellow-wood thickets, the fallen leaves may provide quite a heavy ground cover.

Yellow-wood occurs only in Queensland, where its distribution is restricted to the central and northern coastal and sub-coastal areas. It occurs at Rockhampton, and in the basins of the Sutton, Mackenzie, Burdekin and Belyando Rivers, as well as on the Central Highlands at Springsure.

Plate 214

A Yellow-wood Tree.

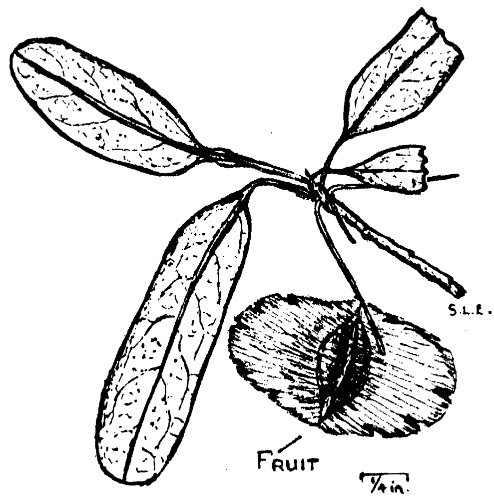


Plate 215.

Twig of Yellow-wood, showing the Winged Seed Capsule.

POISONING OF CATTLE.

Symptoms.

Symptoms of yellow-wood poisoning of cattle are most commonly seen during dry weather; that is, between June and December.

Cattle of both sexes and of all ages may be affected, but if animals exhibit symptoms at an early age, and do not succumb to their initial attack, they may become "chronic wasters."

The first indication that animals are affected is a disinclination to move out of the shade. If forced to do so, they turn away from the sun and stand with eyelids only half open and blinking continuously. There is a fairly copious flow of tears, which run down the side of the face and mat the hair.

As the condition progresses, the animals hold their heads higher than usual, which gives the impression that they are "on the alert" (Plate 216). Animals affected to this extent are inclined to lift their forefeet higher than usual, as though there were some impairment of the vision.

Sometimes the eyes become inflamed and ulcerated, and affected calves may go blind. The skin of the muzzle becomes dry and cracks, and affected beasts lick their nostrils repeatedly. If they refrain from doing this, a yellowish discharge is likely to encrust the nose.

Feeding and cud chewing are usually depressed, but the animal does not lose its appetite completely. By this time, soft, doughy swellings may appear under the lower jaw, or in the brisket or forelegs. These swellings are sometimes brief and their presence may pass undetected.

Urination is more frequent than usual and sometimes there is continuous dribbling, which causes affected females to hold their tails in an arched position, while the skin about the escutcheon becomes

urine stained and scalded. Affected beasts may be constipated, particularly in the early stages. When swellings develop under the jaw or brisket, the faeces may be very soft.

Plate 216.

A Steer Affected by Yellow-wood Poisoning. Note the typical stance—head elevated, ears at the alert and back arched; also the half-closed eyes and the eye discharge.

Some animals have been observed to suffer from a form of founder. They walk on their heels and their toes turn up as the horn grows long.

Many cattleraisers differentiate the condition into a wet and a dry form. In the former, there is an accumulation of fluid under the skin of the lower jaw, brisket or forelegs. In the latter type, there is marked aggravation of the eye symptoms, rapid wasting and early death.

Sometimes relatively mild attacks appear to clear up temporarily, particularly if late winter or early spring rains occur which produce a reasonable flush of grass and herbage. Recovery is seldom complete and it is unusual for cattle which have been affected to fatten beyond "forward" store condition.

In particularly severe outbreaks, yellow-wood poisoning usually has a fatal ending, death occurring in from one to two months after symptoms are first noted. Plate 217 shows an advanced case of yellow-wood poisoning.

Plate 217.
An Advanced Case of Yellow-wood Poisoning. Note the emaciation, the half-closed eyes, and evidence of scouring.

Post-Mortem Findings.

Identical post-mortem findings have been made in cattle suffering from yellow-wood poisoning under both paddock and experimental conditions. The carcase is usually emaciated, but in "wet" cases there may be considerable swelling of tissues just under the skin of the lower jaw, the brisket and the forelegs. These swellings might also involve the wall of the fourth stomach. A yellowish-white fluid exudes from its cut surface, which presents a marbled, jelly-like appearance.

There may be some patchy areas of inflammation along the intestines, but these are rather variable.

The kidneys show the most marked changes, and it is here that the greatest damage is done. Although their shape and size remain unaltered, they show a peculiar discolouration, which ranges from greenish-blue to slate grey. The kidneys consist essentially of a series of filters through which waste products in the blood are passed, ready for excretion through the normal channels. The poison in yellow-wood damages these filters, and as a result they allow some of the nutrients essential for the growth and maintenance of the animal to escape. This is why animals affected by yellow-wood poisoning either lose condition or tend to remain stunted. Unfortunately, the damage to the kidney is irreparable, and although these organs have tremendous reserves, it is difficult for them to adjust themselves to extensive damage.

In some chronic cases the urinary bladder is markedly enlarged and the walls are damaged.

Factors Influencing Poisoning.

Many variations have been noted in the conditions under which yellow-wood poisoning occurs in grazing cattle. These have been related to the following factors:—

(1) *Differences in the density of yellow-wood trees*:—It is well known that the density of yellow-wood varies from paddock to paddock and from property to property. There may be as many as 4,000 trees per acre in thick scrubs, and as few as 20 trees to the acre in paddocks where the plant occurs sparsely. Yellow-wood gives the appearance of being a "leafy" tree, but it was surprising to find during the feeding trials that a well-grown specimen produces only a few pounds of green leaves. A kerosene tinful of leaves seldom weighs as much as 3 lb. unless they are packed very tightly. Only four or five tinsful of leaves could be collected from quite a large tree. This means that the trees must be fairly dense before cattle can get sufficient yellow-wood to affect them adversely.

(2) *Stocking rates*:—If paddocks containing dense yellow-wood scrubs are stocked heavily, the cattle soon eat out the more palatable, nutritious grasses, and they are then forced onto the yellow-wood. Because of this, paddock management is particularly important in preventing the condition.

(3.) *Seasonal conditions*:—There are two aspects of the seasonal conditions which are important. These may be classified as—

(*a*) The long range climatic influences.

(*b*) The weather during the year.

The climate year-in-year-out influences the type of plant community which occurs in any district. Quite noticeable differences occur in the average annual rainfall and in its distribution in the areas where yellow-wood occurs. The country just west of Rockhampton enjoys a better rainfall distribution than that near Clermont or Springsure. In addition, it is appreciably warmer during the winter near the sea than it is on the central highlands. As a result, the pastures in the Rockhampton area respond better to winter rains and the cattle enjoy a more even plane of nutrition than those further west. These differences also influence the amount of yellow-wood the cattle may eat during the drier part of each year, and are probably part of the explanation why yellow-wood poisoning is seen less frequently amongst herds nearer the coast.

The weather during each year exerts a similar but more specific and localised influence, and property owners should not overlook the relationships between rainfall and temperature in determining plant growth and the plane of nutrition enjoyed by grazing cattle.

It is not easy to forecast the circumstances in which yellow-wood poisoning will occur under field conditions. It is well known that cattle are more likely to be affected during dry years or towards the end of winter or during the spring of each year. The stocking rate, the density of the yellow-wood trees, the prevalence of nutritious grasses, and the weather from week to week, all exert their influence

POISONING OF SHEEP.

Yellow-wood poisoning of sheep is not characterised by the wasting that is so typical of its manifestation in cattle. Affected sheep appear quite normal until they are disturbed, when they exhibit unusual fit-like seizures which may last for up to a minute. The affected animals fall to the ground, with their legs protruding stiffly (Plate 218) and with their heads drawn back. The breathing is irregular and there is a tendency to grunt and gasp for breath.

Plate 218.

Sheep in Fit-like Seizures Caused by Yellow-wood Poisoning.

As the fits pass off, the sheep regain the standing position, although they are unsteady on their legs for half a minute or so. They then walk away quite normally.

There is practically no abnormality characteristic of the yellow-wood poisoning of sheep which can be found on post-mortem examination. A bluish-grey colour has been noted in the kidneys of some animals, but this is variable. However, the poisonous principle appears to affect the nervous system, but sheep will recover if they are fed a diet free of yellow-wood.

Yellow-wood poisoning of sheep is important because animals may take fits as they approach water or get cast in some other awkward position and subsequently succumb from misadventure.

FEEDING TRIALS WITH YELLOW-WOOD.

Feeding trials with sheep were conducted in the Emerald district in 1934, and with cattle in the Clermont district in 1944. In both cases, symptoms identical with those observed under field conditions

were observed. A microscopic study of the kidneys of cattle used in the experiments revealed changes identical with those seen under field conditions.

In the feeding tests at Clermont, the disease was reproduced in all eleven cattle which ate varying amounts of yellow-wood, whereas animals in adjacent pens, which were fed lucerne and cereal hay or chaff, were unaffected.

In the majority of the animals fed yellow-wood, the appetite was depressed after about two weeks, when the daily intake of leaves decreased from 7 lb. to 4 lb. per day. Rapid blinking was noticeable by this time. After about one month's feeding there was obvious loss of condition and urination was frequent. After six weeks' feeding, the animals were so emaciated that they found it difficult to stand, and by this time the skin of the nose was cracked and yellow. From these trials, it became apparent that as little as from 4 to 5 lb. of yellow-wood leaves eaten daily was sufficient to produce severe symptoms in from four to six weeks. Sheep were affected within three to four weeks.

PREVENTION OF YELLOW-WOOD POISONING.

Because of the severity of the damage caused to the kidneys by yellow-wood poisoning, it is difficult to treat affected animals. Property management should aim at keeping cattle and sheep off yellow-wood country during the drier periods of the year. This means that they should be moved to yellow-wood free areas by June or July in the majority of seasons.

If it is not possible to unstock the paddocks in which yellow-wood occurs, the minimum number of animals should be grazed in them, and where possible, rotational grazing should be practised.

Owing to its density, the control or eradication of yellow-wood would be expensive on a number of properties, and can only be recommended where local conditions would make it practicable.

Infectious Pneumonia of Swine.

A. K. SUTHERLAND, Senior Veterinary Pathologist,
Animal Health Station, Yeerongpilly.

THE financial success of pig raising depends to a great extent on preventing losses from deaths and sickness. Many pig raisers would be surprised if they kept records of the number of pigs born, the number weaned and the number marketed from their herds. The heaviest mortality occurs in the first week of life, but from the financial aspect infectious pneumonia is the more serious problem because it is prevalent among older, and therefore more valuable animals, namely weaners from 10 to 16 weeks of age.

Infectious pneumonia is prevalent in most parts of Queensland; there are few herds that have not been affected at some time or another. Pneumonia kills many pigs, but even greater loss results from waste of feed and labour on pigs that remain unthrifty or worthless for months after an attack of the disease.

Causes.

A number of micro-organisms (or germs) can cause infectious pneumonia in pigs. The bacterium known as *Salmonella cholerae-suis* (also called *Salmonella suipestifer*) is the one most often found in the lungs of pigs in the acute fatal type of pneumonia. In some cases other bacteria, especially *Pasteurella suiseptica*, are present, either alone or with *S. cholerae-suis*. In yet other cases, none of these bacteria are present, and it is thought that these cases are caused by another infectious agent, probably a virus, although there is no clear proof of this.

The bacterium, *Salmonella cholerae-suis*, which is so often associated with infectious pneumonia, can cause another type of disease in the pig—paratyphoid or salmonellosis. This is a disease in which the bacteria invade the blood stream and kill the pig after a short illness. Some cases of infectious pneumonia end in this way when the salmonella bacteria invade the blood stream from the lungs. Furthermore, *S. cholerae-suis* can infect the bowel, producing the disease called necrotic enteritis in which severe diarrhoea is a feature. Thus, in outbreaks of infectious pneumonia some pigs may die after a brief illness—paratyphoid—and others may exhibit diarrhoea due to necrotic enteritis.

Symptoms.

The symptoms are those of fever and pneumonia. The affected pigs are dull and disinclined to move about. They are usually thirsty but they have poor appetites. Severely affected pigs cough frequently and breathe rapidly, but in milder cases these symptoms may be shown only after exercise. There is often a discharge of pus or mucus from the eyes and nostrils.

The pigs quickly lose weight and become weak. Death may occur one to two weeks after the disease commences.

Some pigs make a good recovery if they are well fed and cared for, but the majority remain unthrifty and stunted for weeks after the acute stage of the disease has passed. The chances of complete recovery are enhanced if correct sulphonamide treatment is commenced in the early stages of the disease.

Post-Mortem Findings.

Healthy lung has a salmon pink colour and a soft spongy texture, and floats in water. In pneumonia, the lung tissue is firm or even solid, and sinks in water. The colour is dark red in the early stages of the disease, and later it becomes greyish, then creamy or white. Sometimes there is fluid in the chest cavity, and occasionally the lungs adhere to the chest wall. The sac around the heart may also contain fluid. Within the lung tissue there are usually many small abscesses containing yellowish pus.

The lymph nodes at the base of the windpipe are usually swollen and juicy. The liver is dark red or purple and there are often many small haemorrhages in the kidneys.

Diagnosis.

The symptoms of pneumonia are usually easy to recognise, but it is sometimes necessary to exercise the pig to detect the coughing and panting. The diagnosis can be confirmed by post-mortem examination. The firm, discoloured lung tissue affected with pneumonia is easily seen and felt.

Although infectious pneumonia is a prevalent disease in pigs after weaning, it is uncommon in suckers. The harsh dry cough often seen in suckers is usually caused by larvae of the large roundworm (*Ascaris lumbricoides*) migrating through the lungs.

Swine influenza is another disease that causes pneumonia in Queensland, but it affects suckers rather than weaners. It spreads rather rapidly through all the youngsters in a herd and produces a cough, discharge from the eyes and nose, and sneezing.

It is sometimes said that even healthy pigs cough when they are fed dry feeds, such as crushed grain, but this is incorrect.

If there is any doubt about the diagnosis or the action to be taken to control an outbreak of disease, then a private veterinarian or an officer of the Department of Agriculture and Stock should be consulted without delay.

Sources of Infection.

Pigs that recover from pneumonia may harbour the disease for a long time, even though they appear healthy. Such animals are called carriers. They discharge infective material in the sputum brought up from the lungs, and perhaps also in their dung and urine. The germs are killed in a few hours by sunlight, dryness, heat or disinfectants, so they do not survive long in dry exposed situations. They will survive, however, for many weeks in moist or wet shaded places.

The chief source of infectious material is an infected pig—either a visibly sick pig or a carrier. Infectious pneumonia is therefore usually brought into healthy herds by purchased pigs. Stores purchased from saleyards are especially dangerous and breeding boars and sows can also infect a clean herd.

Pigs contract the disease by inhaling minute droplets of infected sputum or by eating or drinking material contaminated with the sputum, dung or urine of sick or carrier pigs.

Uncooked pork scraps or butcher's offal may also introduce infectious pneumonia into a piggery, and for this reason as well as others it is required under the Diseases in Stock Acts that all offal and garbage fed to pigs shall be thoroughly boiled.

Conditions That Predispose Pigs To Infection.

Outbreaks of infectious pneumonia occur occasionally in herds kept under good conditions, but the disease is certainly more prevalent and more troublesome in herds kept in insanitary quarters. When the disease is brought into an insanitary piggery, the yards, troughs and sties soon become loaded with disease germs. The micro-organisms that cause infectious pneumonia are destroyed by sunlight and dryness, but they can live in moist shaded places. Thus, herds exposed to low lying, muddy or "pig sick" yards, dirty wallows, or old wooden sties, are predisposed to attacks of infectious pneumonia.

On the other hand, it has sometimes been noted that pneumonia is prevalent in areas which have experienced a long dry spell as a result of which yards and houses have become very dusty. In these instances it is felt that the predisposing factor is the irritation of the lungs caused by inhaled dust particles.

Overcrowding also predisposes a herd to infectious pneumonia because it facilitates the spread of infection from one animal to another.

Pigs that are fed a ration deficient in protein or minerals or vitamins have a low resistance to disease. Green feed is particularly important to ensure a supply of vitamins. If good young green pasture is not available, then high quality leafy lucerne chaff should be fed; this is especially important for pregnant or lactating sows and for weaners up to about 70 lb. liveweight.

The pig does not adjust itself to extremes of heat and cold as well as other domestic animals, and it is the opinion of some authorities that wide variations in environmental temperature increase the susceptibility of the pig to pneumonia. Day to day temperatures sometimes vary tremendously in the autumn and spring of the year, this being especially so in elevated areas some distance from the coast. It is therefore probable that, even in Queensland's generally warm climate, many herds would be benefited by a better type of housing which would assist pigs to withstand marked changes in temperature.

Ill health, however mild, due to internal and external parasites, other infectious diseases or malnutrition may have a bearing on whether a pig withstands or succumbs to exposure to infectious pneumonia.

Herds maintained by buying store pigs for fattening are in constant danger of becoming infected with pneumonia through the introduction of carrier or diseased pigs. High standards of feeding and sanitation are needed to minimize losses in such herds.

Treatment.

Certain sulphonamide drugs are effective for treating infectious pneumonia provided treatment is commenced in the early stages of the disease. Further, the proper dose, according to the weight of the pig, must be given regularly each day for the prescribed period.

Sulphamezathine is the preferred drug. Sulphamerazine is almost, if not equally, as good, while sulphapyridine has also given satisfactory results. The recommended treatments are:—

(*a*) Sulphamezathine or sulphamerazine in the form of powder or 0.5 gram tablets administered once daily by mouth as follows: 1st day—1 gram for each 10 lb. liveweight; 2nd to 4th days—1 gram per 15 lb. liveweight.

(*b*) Sodium sulphamezathine in the form of 33⅓ per cent. solution to be injected subcutaneously once daily at the rate of 3 c.c. per 15 lb. liveweight for 3 to 4 days.

(*c*) Sulphapyridine in the form of powder or 0.5 gram tablets administered by mouth at the rate of 1 gram per 20 lb. liveweight per day divided into two doses (morning and evening) each day. The initial dose on the first day should be a double dose. Treatment is given for 3 to 4 days.

The sodium sulphamezathine solution is injected with a sterile hypodermic syringe. There are several ways to give the treatments that are administered by mouth. The best method is to mix the powder or crushed tablets with milk or water and give it as a drench. In the case of small pigs, the mouth can be held open with a metal gag while the tablets are placed on the back of the tongue with long forceps. Large or intractable pigs can be treated by mixing the drug with a small amount of milk that the pig will drink quickly when hungry—provided, of course, that sickness has not abolished the animal's appetite.

How to Deal with an Outbreak.

When the disease breaks out in one or more groups of pigs, leaving other groups unaffected, then the sick group should be held in isolation, preferably by moving the healthy groups to new quarters. It is sometimes possible to quarantine an affected group by vacating the adjoining pens or yards.

Early treatment with one of the sulphonamides described above is recommended, because it reduces the death rate and it saves many pigs from becoming unthrifty culls. Depending on the severity of the outbreak, one can either treat the whole of an affected group, or one can remove the sick pigs each day to a hospital pen for individual treatment.

Seriously affected pigs rarely make a satisfactory recovery and they are a prolific source of infection, so they should be destroyed. The carcases should be burned or buried.

All the wet or muddy patches in the yards should be either drained or filled in. Concrete wallows can be drained and cleaned, but any other type of wallow should be drained and then allowed to dry out.

The disinfectant action of sunlight should also be utilised. This can be done by removing rubbish and lopping trees and perhaps by lifting the roofs of sheds. Clean metal or concrete surfaces can be disinfected with chemicals, such as 5 per cent. lysol or 5 per cent. caustic soda, but disinfectant solutions cannot be relied upon to kill germs in wood, soil or organic matter. Metal or concrete troughs should therefore be cleaned and disinfected, but wooden troughs should be burned. All litter and rubbish should be removed from the yards, then burned or disposed of where it will not be accessible to pigs.

The sick pigs and *all* pigs that have had contact with them should be held in quarantine and then sold for slaughter as soon as they are marketable. There are likely to be carriers of infection among the recovered pigs even though they may have received sulphonamide treatment.

The most important point of all, however, is that an attempt should be made to rear the succeeding generation of pigs free of pneumonia. The desired breeders are healthy sows that have not previously had an

attack of pneumonia. These sows should be isolated from the rest of the herd, particularly when they are pregnant and when they are rearing litters. This breaks the cycle of infection from the carriers among the older stock back to the susceptible young pigs. When these young pigs are weaned they should run with others of their own age, and again they should have no contact with the older infected stock. There is an odd carrier sow that will transmit infection to her litter and so cause a breakdown in the eradication plan, but it is usually possible within a few generations to eliminate pneumonia from a herd by this procedure.

To carry through this plan, appropriate pen and pasture accommodation is essential for keeping the different age groups segregated. When the older infected stock are sold for slaughter, the yards they have occupied should be cleaned and disinfected as described above. If the yards are dry, and if they are left vacant for about a month to allow infection to die out, they can be used for the young replacement stock.

Prevention.

In view of the grave risk of introducing infection with pigs bought from saleyards or from herds that are not unquestionably free of pneumonia, every pig raiser should aim to breed his own pigs. The owner of a disease-free herd should take particular care to avoid introducing infection by either direct or indirect contact with other herds. If it is necessary to introduce new breeding stock, then they should be carefully selected from a disease-free herd, and they should be held in quarantine for at least a month before being allowed to mingle with the home-bred stock.

Herds maintained by purchasing stores from many sources can hardly escape infection. The chances of infection are reduced to some extent by avoiding introduction of all pigs that have had contact with animals showing a cough, discharge from the eyes or nose, diarrhoea or unthriftiness. In any case, high standards of sanitation and feeding are needed to minimize losses in herds of this type.

Large roundworm infestation should be controlled by sanitation and sodium fluoride treatment, because the larvae of this worm migrate through the lungs, and the damage they do probably facilitates the establishment of infectious pneumonia in the devitalised lung tissue.

It will be apparent also, from the discussion of predisposing factors, that, to prevent infectious pneumonia, feeding and sanitation should be good, and the housing should protect the pigs from exposure to wide variations in temperature.

The most important point, however, and one that cannot be overemphasized, is that each new generation should be reared as a disease-free unit by segregating breeding sows, suckers and weaners from the older potentially infected stock.

Although vaccines for infectious swine pneumonia are marketed under a variety of names, such as swine plague vaccine, suipestifer vaccine, and contagious pneumonia vaccine, they are not effective in preventing the disease.

The Bacon Pig.

F. BOSTOCK, Officer in Charge, Pig Branch.

THE pig industry to-day is beginning to receive the close attention of farmers which it should have been given years ago, instead of being looked upon as a side-line to dairying. However, it must be realised that the day of "hit and miss" methods in building up a successful local and export trade has gone forever. In these times of keen competition success can only be attained by farmers who are prepared to study the demands of the consumer and realise that a first class product cannot be produced from a second class pig, no matter how efficient factory management or cure may be.

Much depends on the careful selection of boars and sows; therefore when choosing breeding stock, very careful consideration should be given to their selection. It is very true that far too many pigs of wrong type are brought on to farms where brood stock selection has not received proper attention.

To assist in this selection of breeding stock the conformation of a bacon pig should be better understood and the following features, starting at the head and working back through the body, should be considered:—

Head with Jowl and Neck, which consists largely of bone and is of low value, should be light, with no coarse fat at the jowl or neck.

Shoulders and Fore End should be light, free from wrinkles and coarseness. The collar consist largely of overlapping muscles and gristle and is a cheap cut.

Back should be long and level; it demands a high price per lb. and length means quantity, while level denotes weight and depth of loin. The fat should not exceed $1\frac{1}{2}$ inches at any point.

Sides should be level and moderately deep. Distention of the lower part is accompanied by thin belly cuts, while a moderately deep side affords good depth of prime back cuts and undercuts.

Underline should be straight. The thin streak and flank cuts are not unduly distended or thin.

Plate 219

Correct type Baconer.

Belly should be thick in flesh, because the value is increased by thickness.

Flank should be thick and handle firm and should be in line with the sides.

Ham should be broad, wide, and deep to the hock. These characteristics denote plenty of flesh. No depression should be visible at the tail, as it indicates excessive fat.

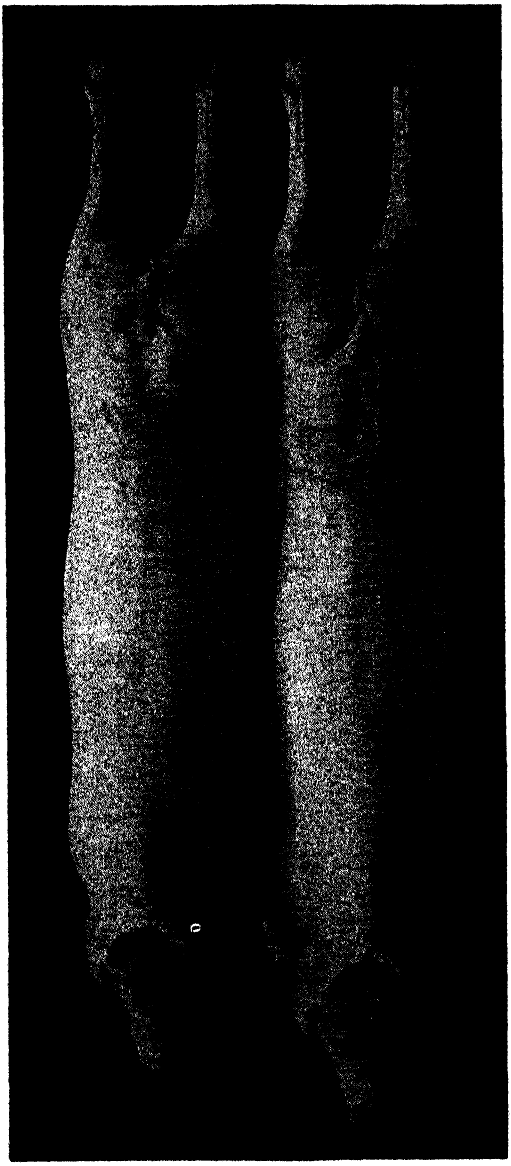


Plate 220.

Comparison in Carcass Length.

Tail should be set high, which denotes a higher proportion of flesh than when set low. However, a tail set too high indicates excessive backfat.

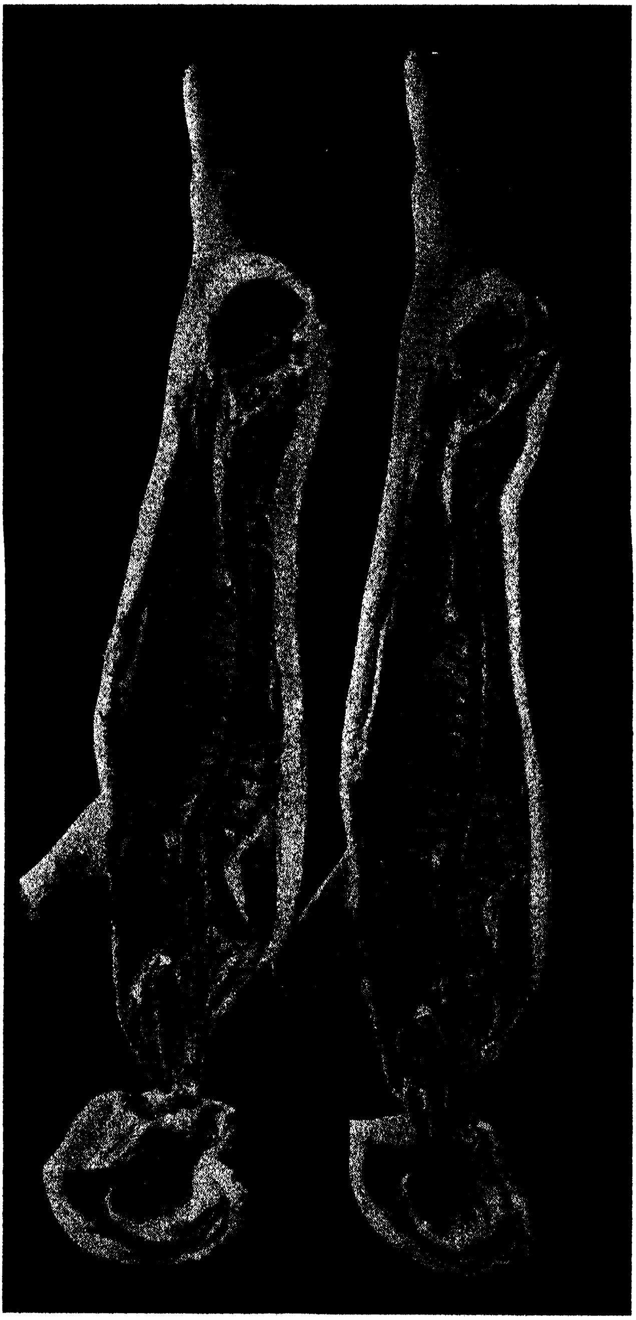


Plate 221.

Comparison of Fat Development.

Legs should be set wide apart and the pig stand well up on its toes.

Bone should be fine, which indicates quality and does not detract from weight.

Skin must be free from coarseness and wrinkle.

Hair should be fine, indicating breeding.

Now, consider briefly the pig after slaughter, by a description of the main carcass points, which may be divided into three sections. 1. Marketing points—colour, skin and dressing; 2. Breeders' points by inspection; and 3. Breeders' points by measurement. (Hammond System.)

Marketing Points.

Colour should be a clean fresh white; dark colouration due to pigmented skin, sunburn before slaughter or excessive drying in storage should be avoided.

Skin should be smooth and not too thick or coarse.

Dressing.—Bruises and weals due to fighting before slaughter, hits from sticks, kicks when loading, or bruises from fighting in truck or lorry should be absent. There should be a complete absence of hair or scraper cuts.

Breeders' points by inspection.

Hams.—The bone should be fine and ham well filled out with lean meat; the space between the legs U rather than V shaped.

Shoulders.—These should be light in proportion to the rest of the carcass, because it is a low priced cut.

Streak.—Not only should the belly be thick, but it should contain a high proportion of lean meat.

Breeders' points by measurement.

Body Length.—This is measured from the edge of the pubis bone to the junction of the sternum with the first rib. It gives a measure of the length of the valuable loin joint which can be cut from the carcass. A high proportion of this to the weight of carcass as a whole increases the value for cutting purposes.

Leg Length.—This is measured in a straight line from the edge of the pubis bone to the tip of the toe. When taken in relation to weight of carcass, it gives a measure of the amount of bone in the carcass.

The side is now cut through at the level of the last rib. This position was selected, because not only does it expose the most valuable part, but also the latest developing part of the carcass, thus affording the best index of the state of the development of the carcass as a whole.

Eye Muscle of Loin.—Maximum depth of eye muscle, the measurement of which is taken at right angles to the long axis, and as near to the centre as is practicable. This gives the best measure of lean meat throughout the carcass.

Backfat.—This is measured 1½ inches from the middle line, with one point of the calipers at the edge of the eye muscle and the other just on the inner layer of the skin. This gives a better measure of the amount of fat in the carcass than does the measurement of the fat at the shoulder, because it is the last part of the back to develop.

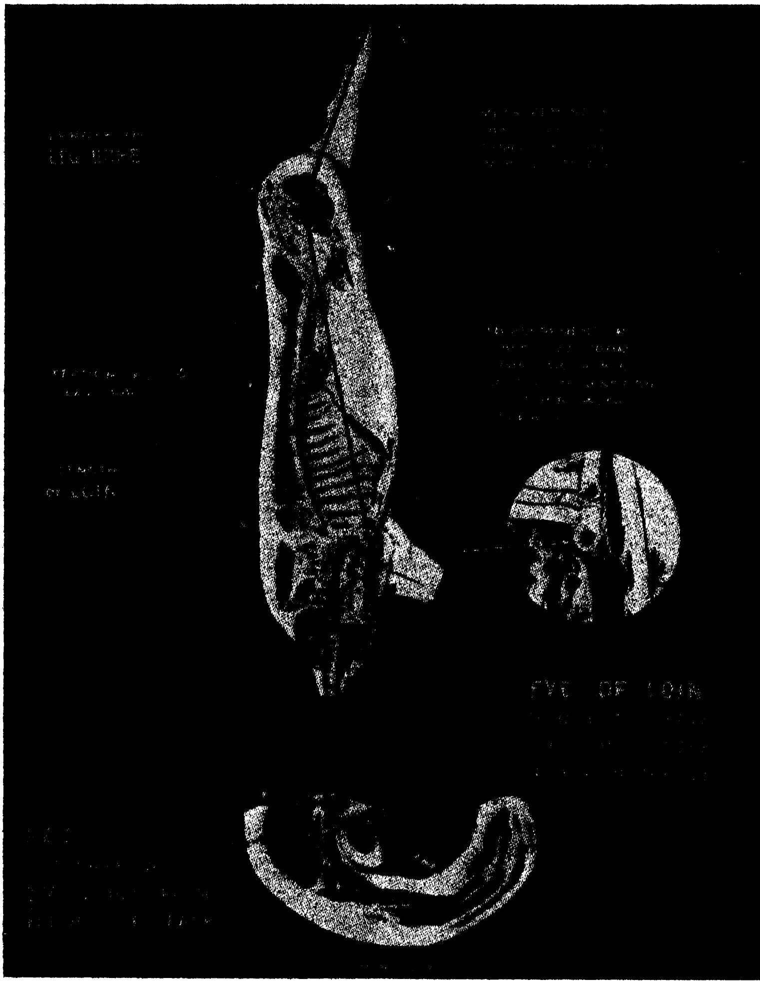
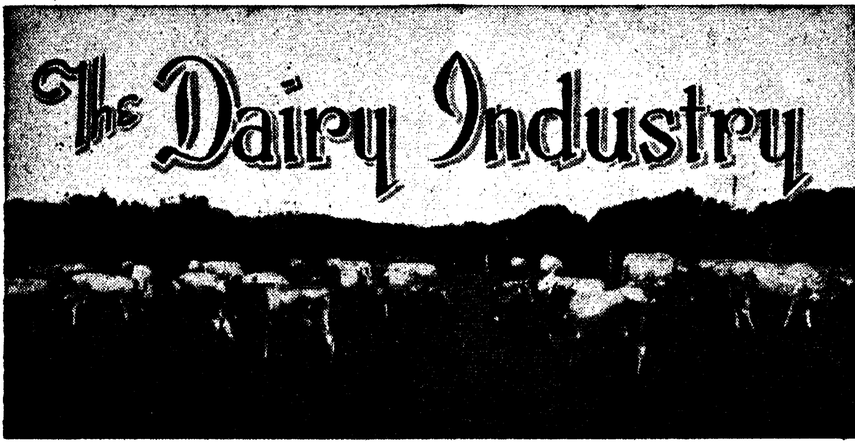


Plate 222.

Hammond System of Carcass Judging.

Having considered the conformation of the different parts of the bacon pig, sight should not be lost of the fact that good conformation does not altogether denote good quality meat, which so largely depends on feeding.

Breeding exerts the greatest influence on the general conformation, but feeding influences the quality of the flesh, also colour and texture of the meat and, to some extent, the quality of the bone.



Queensland Butter Production, 1949-1950.

PREPARED BY THE DIVISION OF DAIRYING.

THE output of Queensland butter factories for the year ended 30th June, 1950, was 107,958,527 lb. Seasonal conditions were good throughout the year and the third successive increase in production since the serious drought of 1946-1947 was recorded. The graph in Plate 223 shows the fluctuations in annual production since the record year of 1938-1939.

The system whereby the price received by dairymen is based upon the estimated cost of production is still in operation, and consequent upon a further survey by the Joint Dairy Industry Advisory Committee the Commonwealth Government agreed to a further increase of 2½d. per pound of commercial butter to the producer, making his return 2s. 4½d. per pound for choice grade butter. This system of a guaranteed price has provided a measure of stability for the industry which should place producers in a sound financial position and permit them to effect improvements to their properties and equipment.

One feature of the price structure is that notwithstanding the substantial increase in price which has taken place over the past six years the differential between the various grades has remained constant at ½d. per pound between choice and first grades and 1d. per pound between first and second grades. The result of this is that whereas in 1942-1943, when the average price was 1s. 4d. per pound, suppliers of lower grade cream received 3⅛ per cent less for first grade and 9⅜ per cent. less for second grade, the margins are now down to 1¾ per cent. and 5¼ per cent. The result is that the monetary incentive to produce choice cream is now so slight that it is doubtful if it has any effect at all.

During the year two events of importance to the industry were the lifting in May of the order restricting the sale of cream and the abolition of butter rationing in June. The effect of the former is already noticeable in the increased sales of cream by factories in the larger centres of population and these sales appear likely to become a profitable adjunct to factory operations. They will, of course, result in some

reduction in the quantity of butter manufactured, and this combined with the abolition of rationing will lessen the quantity of butter available for export.

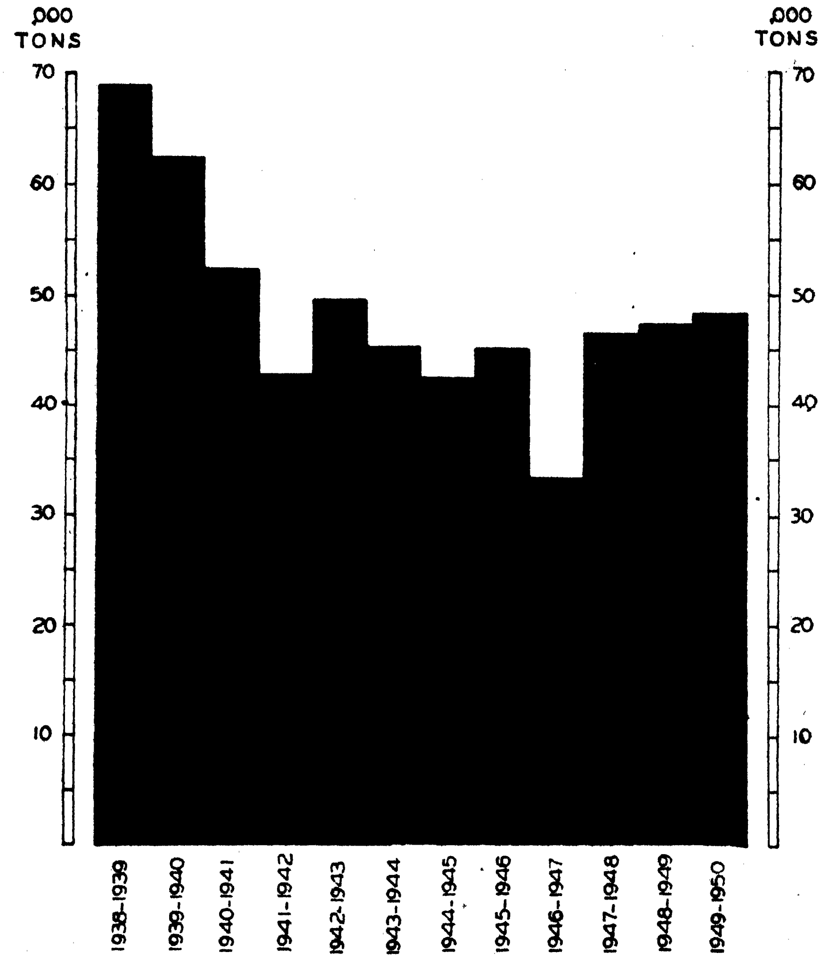


Plate 223.

Diagram Showing Butter Production Since 1938-39.

Gradings.

The factory gradings of all butter manufactured were as follows:—

Choice	Boxes.	Percentage.
First	1,207,228	62·6
Second	652,283	33·8
Pastry	68,224	3·5
	95	..
	1,927,830	

Of this quantity, 1,648,146 boxes, or 85·5 per cent., were submitted for official grading. The butter submitted was made up as follows (factory gradings):—

	Boxes	Percentage
Choice	976,865	59·3
First	605,094	36·7
Second	66,138	4·0
Pastry	49	..

The results of the official gradings are set out in the following summary:—

Submitted as—		Graded as—				
Grade.	Total.	Choice.	First.	Second.	Pastry.	Prohibited from Export.
	Boxes.	Boxes.	Boxes.	Boxes.	Boxes.	Boxes.
Choice ..	976,865	818,363	157,752	602	67	79
First	605,094	..	583,853	20,632	308	301
Second ..	66,138	..	..	59,412	6,662	64
Pastry ..	49	..	..	..	49	..
Totals ..	1,648,146	818,363 49·65%	741,605 45·0%	80,648 4·89%	7,086 0·43%	444 0·03%

The percentage of butter graded as choice (49·65) shows a substantial improvement over the previous year, when the figure was 42·27, but is slightly below the figure of 50·99 achieved in 1947-1948.

Following is a summary of the manufacture and pays in grades for the whole State. It is followed by the figures for manufacture, pay and gradings of each individual factory.

Production in Grades (lb.).

Total.	Choice.	First.	Second.	Pastry.
107,958,527	67,604,786	36,527,855	3,820,566	5,320

Pay in Grades (lb.).

Total.	Choice.	First.	Second.	Pastry.
108,055,302	67,118,459	37,623,073	3,312,575	1,195

Over-run.

Actual	3·03 per cent.
Paid	3·08 per cent.

PRODUCTION, PAYMENTS AND GRADINGS OF BUTTER IN QUEENSLAND, 1949–50.

PRODUCTION AND PAYMENTS.

Factory.		Total.	Manufacture and Payments in Lb.				Over-run.		Make Graded.
			Choice.	First.	Second.	Pastry.	Actual.	Paid.	Per Cent.
Atherton Tableland Association, Malanda	Make	2,328,094	2,328,094	. .	. .	. .	73,700	73,690	. .
	Pay	2,328,084	3,203,435	. .	24,649	. .	3·27%	3·27%	31·4
Caboolture Association, Caboolture	Make	2,489,144	2,200,615	288,529	. .	. .	103,906	103,203	. .
	Pay	2,488,441	2,275,449	204,033	8,959	. .	4·36%	4·33%	75·25
Caboolture Association, Pomona	Make	1,667,745	1,572,290	93,943	1,512	. .	49,840	49,588	. .
	Pay	1,667,493	1,619,969	46,994	530	. .	3·08%	3·06%	100·0
Caboolture Association, Eumundi	Make	2,073,461	1,866,765	206,696	. .	. .	69,743	70,231	. .
	Pay	2,073,949	1,912,943	160,462	544	. .	3·48%	3·51%	76·46
Chinchilla	Make	1,896,130	708,482	893,760	292,768	1,120	13,483	12,871	. .
	Pay	1,895,518	722,812	946,493	225,400	813	0·72%	0·68%	93·25
Daintree Association, Mossman	Make	83,602	25,472	58,130	. .	. .	2,982	2,892	. .
	Pay	83,602	25,472	58,130	. .	. .	3·7%	3·7%	. .
Dayboro'	Make	383,824	. .	383,824	. .	. .	*3,535	Nil	. .
	Pay	428,718	401,704	26,983	31	. .	0·83%	. .	81·67
Downs Association, Toowoomba	Make	2,691,291	1,590,555	898,856	201,880	. .	73,459	73,715	. .
	Pay	2,691,547	1,568,839	924,289	198,419	. .	2·81%	2·82%	61·55
Downs Association, Clifton	Make	1,119,440	804,720	314,272	448	. .	36,665	36,660	. .
	Pay	1,119,435	802,066	316,570	799	. .	3·39%	3·39%	93·36
Downs Association, Dalby	Make	2,702,726	713,046	1,904,224	82,768	2,688	84,158	84,086	. .
	Pay	2,702,654	688,444	1,951,570	62,640	. .	3·21%	3·21%	92·15
Downs Association, Miles	Make	940,052	105,840	674,744	159,468	. .	26·166	26,168	. .
	Pay	940,054	106,268	674,974	158,812	. .	2·86%	2·86%	91·78
Downs Association, Crow's Nest	Make	1,647,520	724,360	891,520	31,640	. .	49,607	49,567	. .
	Pay	1,647,480	725,063	891,237	31,180	. .	3·10%	3·10%	97·76

* Includes C. B. Content of Cream Sold.

OFFICIAL GRADINGS IN BOXES.

Factory.	Boxes Submitted As Choice.	Result of Official Grading.				Boxes Submitted As First.	Result of Official Grading.			Boxes Submitted As Second.	Result of Official Grading.		Boxes Submitted As Pastry.
		Choice.	First.	Second.	Pastry.		First.	Second.	Pastry.		Second.	Pastry.	
Atherton Tableland Association, Malanda	12,563	12,481 99·35%	82 0·65%	..	..	197	..	197 100·0%	..	295	186 63·05%	109 36·95%	..
Caboolture Association, Caboolture	28,340	24,235 85·52%	4,103 14·48%	1	1	5,106	4,624 90·56%	482 9·44%	..	..	..	..	..
Caboolture Association, Pomona	26,604	16,619 62·47%	9,985 37·53%	..	..	1,680	1,025 61·01%	655 38·99%	..	..	..	..	..
Caboolture Association, Eumundi	29,663	10,594 35·71%	19,069 64·29%	..	..	3,591	2,014 56·08%	1,577 43·92%	..	38	..	38 100·0%	..
Chinchilla	10,541	7,935 75·28%	2,571 24·39%	35 0·33%	..	15,903	15,368 96·64%	535 3·36%	..	5,130	3,433 66·92%	1,697 33·08%	..
Daintree Association	No	Gradings											
Dayboro'	..	..	..	..	..	5,598	5,565 99·41%	33 0·59%	..	..	..	..	..
Downs Association, Toowoomba	10,380	10,019 96·52%	361 3·48%	..	..	15,962	15,790 98·92%	172 1·08%	..	2,730	2,578 94·43%	152 5·57%	..
Downs Association, Clifton	13,051	12,920 99·0%	131 1·0%	..	..	5,604	5,457 97·38%	76 1·36%	71 1·26%	8	8 100·0%	..	..
Downs Association, Dalby	8,715	8,441 96·86%	274 3·14%	..	..	34,221	34,026 99·43%	195 0·57%	..	1,488	1,247 83·8%	241 16·2%	24
Downs Association, Miles	459	312 67·97%	147 32·03%	..	..	11,904	10,725 90·1%	1,179 9·9%	..	2,828	2,345 82·92%	483 17·08%	..
Downs Association, Crow's Nest	12,130	9,956 82·08%	2,174 17·92%	..	..	16,050	15,931 99·26%	119 0·74%	..	581	552 95·01%	29 4·99%	..

PRODUCTION, PAYMENTS AND GRADINGS OF BUTTER IN QUEENSLAND 1949-50—*continued.*

Factory.		Total.	Manufacture and Payments in Lb.				Over-run.		Make Graded.
			Choice.	First.	Second.	Pastry.	Actual.	Paid.	Per Cent.
Downs Association, Goombungee	Make	1,664,992	704,816	960,176	..	..	45,513	45,524	..
	Pay	1,665,003	706,299	958,704	..	..	2·81%	2·81%	98·72
Downs Association, Jandowae	Make	2,208,246	837,020	1,204,616	166,600	..	60,649	60,731	..
	Pay	2,208,328	837,163	1,205,389	165,776	..	2·82%	2·83%	98·97
Esk	Make	2,470,138	1,450,266	1,015,448	4,424	..	66,982	66,937	..
	Pay	2,470,093	1,476,543	988,637	4,913	..	2·79%	2·79%	96·63
Evelyn Tableland Association, Ravenshoe	Make	497,438	238,756	258,682	..	..	19,925	19,849	..
	Pay	497,362	491,257	5,701	404	..	4·17%	4·16%	47·96
Gayndah	Make	1,541,928	950,176	537,544	54,208	..	51,840	52,075	..
	Pay	1,542,163	958,983	534,939	48,241	..	3·48%	3·49%	95·88
Killarney	Make	1,588,170	799,522	647,752	140,896	..	38,411	37,955	..
	Pay	1,587,714	824,679	649,982	113,053	..	2·48%	2·45%	77·33
Logan and Albert Association, Beaudesert	Make	3,452,023	1,674,283	1,694,064	83,676	..	105,728	106,389	..
	Pay	3,452,684	1,779,564	1,594,777	78,343	..	3·16%	3·18%	97·61
Maleny	Make	2,701,209	2,523,185	178,024	..	..	79,724	80,023	..
	Pay	2,701,508	2,568,827	129,946	2,735	..	3·04%	3·05%	19·64
Maryborough Association, Maryborough	Make	843,674	548,232	275,842	19,600	..	26,126	26,739	..
	Pay	844,287	575,983	259,182	9,122	..	3·2%	3·27%	31·42
Maryborough Association, Biggenden	Make	1,825,026	869,106	955,920	..	..	69,613	69,346	..
	Pay	1,824,759	938,320	886,374	65	..	3·97%	3·95%	91·99
Maryborough Association, Kingaroy	Make	4,141,635	3,738,250	263,200	140,185	..	195,726	195,354	..
	Pay	4,141,263	3,789,356	237,994	113,913	..	4·96%	4·95%	61·21
Maryborough Association, Mundubbera	Make	2,756,238	2,308,742	357,392	90,104	..	81,468	81,397	..
	Pay	2,756,167	2,343,255	337,684	75,228	..	3·05%	3·04%	97·47
Maryborough Association, Wondai	Make	2,865,808	1,964,192	846,832	54,784	..	88,200	88,874	..
	Pay	2,866,482	2,070,415	753,450	42,617	..	3·18%	3·2%	96·95

OFFICIAL GRADINGS IN BOXES—*continued.*

Factory.	Boxes Submitted As Choice.	Result of Official Grading.				Boxes Submitted As First.	Result of Official Grading.			Boxes Submitted As Second.	Result of Official Grading.		Boxes Submitted As Pastry.
		Choice.	First.	Second.	Pastry.		First.	Second.	Pastry.		Second.	Pastry.	
Downs Association, Goombungee	12,180	9,771 80·22%	2,409 19·78%	..	..	17,172	16,871 98·25%	301 1·75%	..	..	..	..	..
Downs Association, Jandowae	14,210	12,190 85·78%	2,020 14·22%	..	..	21,707	21,376 98·48%	331 1·52%	..	3,110	2,786 89·58%	324 10·42%	..
Esk	24,541	19,114 77·89%	5,427 22·11%	..	..	18,001	17,951 99·72%	50 0·28%	..	79	39 49·37%	40 50·63%	..
Evelyn Tableland Association, Ravenshoe	2,965	2,965 100·0%	..	..	..	1,295	1,295 100·0%	..	..	..	..	..	..
Gayndah	15,935	10,759 67·52%	5,145 32·29%	31 0·19%	..	9,542	8,693 91·1%	849 8·9%	..	923	671 72·7%	252 27·3%	..
Killarney	7,913	6,549 82·76%	1,364 17·24%	..	..	11,625	11,515 99·05%	110 0·95%	..	2,393	2,348 98·12%	45 1·8%	..
Logan and Albert Association, Beaudesert	28,395	19,944 70·24%	8,451 29·76%	..	..	30,241	29,106 96·25%	1,135 3·75%	..	1,534	1,522 99·22%	12 0·78%	..
Maleny	41,023	35,950 87·63%	4,917 11·99%	156 0·38%	..	3,179	2,871 90·31%	308 9·69%	..	..	..	..	..
Maryborough Association, Maryborough	1,798	23 1·28%	1,775 98·72%	..	..	2,618	2,241 85·6%	377 14·4%	..	317	137 43·22%	180 56·78%	..
Maryborough Association, Biggenden	13,219	8,120 61·43%	5,027 38·03%	72 0·54%	..	16,761	16,245 96·92%	516 3·08%	..	..	..	..	..
Maryborough Association, Kingaroy	39,189	37,323 95·24%	1,866 4·76%	..	..	3,766	3,750 99·58%	16 0·42%	..	2,311	2,208 95·54%	103 4·46%	..
Maryborough Association, Mundubbera	40,002	23,702 59·25%	16,300 40·75%	..	..	6,375	3,883 60·91%	2,492 39·09%	..	1,596	728 45·61%	868 54·39%	..
Maryborough Association, Wondai	33,548	29,751 88·68%	3,797 11·32%	..	..	15,112	14,875 98·43%	237 1·57%	..	952	840 88·24%	112 11·76%	..

PRODUCTION, PAYMENTS AND GRADINGS OF BUTTER IN QUEENSLAND, 1949–50—*continued.*

Factory.	Total.		Manufacture and Payments in Lb.				Over-run.		Make Graded.
			Choice.	First.	Second.	Pastry.	Actual.	Paid.	Per Cent.
Millaa Millaa	Make	901,220	901,220	..	..	..	25,627	26,804	..
	Pay	902,397	902,351	..	46	..	2·93%	3·06%	52·57
Millmerran	Make	1,130,363	271,323	691,712	165,918	1,400	25,834	25,965	..
	Pay	1,130,494	300,298	700,637	129,559	..	2·34%	2·35%	92·03
Nanango	Make	2,935,155	1,072,979	861,448	728	..	98,640	98,622	..
	Pay	2,935,137	2,309,825	620,836	4,476	..	3·48%	3·48%	97·56
Oakey	Make	4,085,006	2,324,310	1,349,656	411,040	..	126,937	126,773	..
	Pay	4,084,842	2,322,142	1,410,754	351,946	..	3·21%	3·20%	94·98
Port Curtis Association, Gladstone	Make	1,352,763	832,002	506,730	14,031	..	23,438	27,927	..
	Pay	1,357,252	351,692	989,767	15,684	109	1·76%	2·1%	85·2
Port Curtis Association, Bundaberg	Make	1,791,054	466,257	1,321,157	3,640	..	50,226	50,747	..
	Pay	1,791,575	437,461	1,350,371	3,711	32	2·89%	2·92%	66·16
Port Curtis Association, Wowan	Make	2,319,991	1,722,140	580,891	16,960	..	18·430	47,896	..
	Pay	2,348,457	1,366,384	965,095	16,978	..	0·8%	2·04%	88·75
Port Curtis Association, Rockhampton	Make	1,447,087	179,178	1,204,405	63,504	..	30,312	35,725	..
	Pay	1,452,500	185,491	1,205,393	61,616	..	2·14%	2·52%	23·44
Port Curtis Association, Monto	Make	3,726,917	3,141,493	545,944	39,480	..	84,220	84,251	..
	Pay	3,726,948	2,088,782	1,605,801	32,365	..	2·31%	2·31%	97·37
Port Curtis Association, Mackay	Make	599,111	199,496	396,149	3,466	..	8,200	12,380	..
	Pay	603,291	199,733	399,970	3,588	..	1·39%	2·1%	..
Port Curtis Association, Biloela	Make	3,760,193	2,289,489	1,456,852	13,852	..	82,060	82,074	..
	Pay	3,760,207	1,346,870	2,402,990	10,347	..	2·23%	2·23%	75·16
Q.A.H.S. and College, Lawes	Make	67,868	57,228	6,832	3,808	..	1,094	1,110	..
	Pay	67,884	57,600	8,098	2,186	..	1·64%	1·66%	19·4
Queensland Farmers', Booval	Make	3,545,287	1,282,981	1,817,704	444,490	112	96,208	97,173	..
	Pay	3,546,252	1,289,577	1,887,706	368,969	..	2·79%	2·82%	75·48

OFFICIAL GRADINGS IN BOXES—*continued.*

Factory.	Boxes Submitted As Choice.	Result of Official Grading.				Boxes Submitted As First.	Result of Official Grading.			Boxes Submitted As Second.	Result of Official Grading.		Boxes Submitted As Pastry.
		Choice.	First.	Second.	Pastry.		First.	Second.	Pastry.		Second.	Pastry.	
Millaa Millaa	2,707	2,707 100·0%	..	..	..	5,753	5,753 100·0%	..	..	..	..	..	..
Millmerran	3,272	2,237 68·37%	1,035 31·63%	..	..	12,321	11,091 90·02%	1,230 9·98%	..	2,958	2,440 82·49%	518 17·51%	25
Nanango	35,795	29,803 83·26%	5,946 16·61%	46 0·13%	..	15,328	14,389 93·87%	770 5·02%	169 1·1%	13	13 100·0%	..	..
Oakey	38,179	34,052 89·19%	4,127 10·81%	..	..	24,226	23,916 98·72%	310 1·28%	..	6,878	6,864 99·8%	14 0·2%	..
Port Curtis Association, Gladstone	12,118	12,043 99·38%	75 0·62%	..	..	8,333	8,025 96·3%	308 3·7%	..	131	131 100·0%	..	..
Port Curtis Association, Bundaberg	2,460	2,346 95·37%	114 4·63%	..	..	18,635	18,635 100·0%	..	..	65	..	65 100·0%	..
Port Curtis Association, Wowan	26,915	24,929 92·62%	1,986 7·38%	..	..	9,538	8,843 92·71%	695 7·29%	..	260	214 82·31%	46 17·69%	..
Port Curtis Association, Rockhampton	..	..	..	..	..	5,034	4,907 97·48%	127 2·52%	..	1,024	812 79·3%	212 20·7%	..
Port Curtis Association, Monto	54,433	50,091 92·02%	4,342 7·98%	..	..	9,661	9,621 99·59%	40 0·41%	..	705	531 75·32%	174 24·68%	..
Port Curtis Association, Mackay	No	gradings											
Port Curtis Association, Biloela	29,778	28,231 94·8%	1,547 5·2%	..	..	20,477	20,312 99·19%	165 0·81%	..	209	209 100·0%	..	..
Q.A.H.S. and College, Lawes	..	..	..	..	..	148	135 91·22%	13 8·78%	..	75	75 100·0%	..	..
Queensland Farmers', Booval	7,473	5,215 69·78%	2,258 30·22%	..	..	32,750	32,622 99·61%	128 0·39%	..	7,565	7,522 99·43%	43 0·57%	..

PRODUCTION, PAYMENTS AND GRADINGS OF BUTTER IN QUEENSLAND, 1949–50—*continued.*

Factory.		Total.	Manufacture and Payments in Lb.				Over-run.		Make Graded.
			Choice.	First.	Second.	Pastry.	Actual.	Paid.	Per Cent.
Queensland Farmers', Boonah	Make	4,167,198	2,013,439	1,928,880	224,879	. .	147,921	147,819	. .
	Pay	4,167,096	2,097,166	1,907,705	162,225	. .	3·68%	3·68%	97·78
Queensland Farmers', Laidley	Make	1,958,806	1,014,052	887,061	57,693	. .	71,935	71,878	. .
	Pay	1,958,749	1,063,463	846,191	49,095	. .	3·81%	3·81%	95·62
Queensland Farmers', Grantham	Make	2,309,103	562,071	1,737,680	9,352	. .	75,822	75,818	. .
	Pay	2,309,099	579,999	1,721,231	7,869	. .	3·4%	3·39%	95·8
Queensland Farmers', Lowood	Make	911,837	240,648	652,332	18,857	. .	22,070	22,824	. .
	Pay	912,591	235,854	661,351	15,386	. .	2·48%	2·55%	95·62
Roma	Make	890,048	. .	543,968	346,080	. .	27,490	27,490	. .
	Pay	890,048	164,257	389,470	336,080	241	3·19%	3·19%	53·18
South Burnett Association, Murgon	Make	2,761,250	1,521,578	1,236,144	3,528	. .	87,320	87,932	. .
	Pay	2,761,862	1,872,310	887,537	2,015	. .	3·27%	3·29%	96·12
South Burnett Association, Proston	Make	1,548,000	1,030,280	483,224	34,496	. .	48,643	48,714	. .
	Pay	1,548,071	1,093,340	427,005	27,726	. .	3·24%	3·25%	96·53
Kingston	Make	4,097,296	2,629,984	1,329,888	137,424	. .	157,304	157,269	. .
	Pay	4,097,261	2,637,142	1,343,742	116,377	. .	3·99%	3·99%	98·9
Woodford	Make	1,167,571	995,819	171,752	. .	. .	32,886	34,090	. .
	Pay	1,168,775	1,027,585	141,152	38	. .	2·9%	3·00%	98·61
Warwick	Make	1,387,283	1,313,643	54,712	18,928	. .	38,555	44,025	. .
	Pay	1,392,753	1,170,010	209,783	12,960	. .	2·86%	3·26%	61·32
Allora	Make	1,387,091	1,336,891	28,120	22,080	. .	40,304	40,274	. .
	Pay	1,387,061	1,331,387	34,699	20,975	. .	2·99%	2·99%	88·63
Inglewood	Make	326,312	156,128	153,216	16,968	. .	8,554	9,283	. .
	Pay	327,041	110,023	200,101	16,917	. .	2·69	2·92%	54·97
Texas	Make	90,736	. .	90,736	. .	. .	3,235	3,249	. .
	Pay	90,750	3,502	78,170	9,078	. .	3·7%	3·71%	. .

OFFICIAL GRADINGS IN BOXES—*continued.*

Factory.	Boxes Submitted As Choice.	Result of Official Grading.				Boxes Submitted As First.	Result of Official Grading.			Boxes Submitted As Second.	Result of Official Grading.		Boxes Submitted As Pastry.
		Choice.	First.	Second.	Pastry.		First.	Second.	Pastry.		Second.	Pastry.	
Queensland Farmers', Boonah	33,934	27,243 80·28%	6,608 19·47%	83 0·24%	. .	34,709	34,604 99·7%	105 0·3%	. .	4,121	4,002 97·11%	119 2·89%	. .
Queensland Farmers', Laidley	16,584	14,361 86·6%	2,223 13·4%	. .	. .	15,847	15,422 97·44%	405 2·56%	. .	1,037	874 84·28%	163 15·72%	. .
Queensland Farmers', Grantham	8,274	5,608 67·78%	2,666 32·22%	. .	. .	31,062	30,675 98·75%	387 1·25%	. .	167	150 89·82%	17 10·18%	. .
Queensland Farmers', Lowood	3,509	2,904 82·76%	605 17·24%	. .	. .	11,720	11,471 97·88%	249 2·12%	. .	341	256 75·07%	85 24·93%	. .
Roma	. .	. .	. .	. .	. .	2,311	2,299 99·48%	12 0·52%	. .	6,142	6,142 100·0%	. .	. .
South Burnett Association, Murgon	25,261	19,926 78·88%	5,281 20·9%	54 0·21%	. .	22,069	21,870 99·1%	131 0·59%	68 0·3%	63	63 100·0%	. .	. .
South Burnett Association, Proston	17,793	10,902 61·27%	6,891 38·73%	. .	. .	8,451	7,969 94·3%	482 5·7%	. .	619	489 79·0%	130 21·0%	. .
Kingston	46,245	45,801 99·04%	444 0·96%	. .	. .	23,650	23,605 99·81%	45 0·19%	. .	2,443	2,296 93·98%	147 6·02%	. .
Woodford	17,493	14,300 81·75%	3,178 18·17%	15 0·08%	. .	3,052	2,926 95·87%	126 4·13%	. .	14	14 100·0%	. .	. .
Warwick	13,868	12,578 90·7%	1,290 9·3%	. .	. .	977	956 97·85%	21 2·15%	. .	346	274 79·19%	72 20·81%	. .
Allora	21,010	20,515 97·64%	495 2·36%	. .	. .	563	465 82·59%	98 17·41%	. .	381	381 100·0%	. .	. .
Inglewood	216	54 25·0%	162 75·0%	. .	. .	2,735	2,451 89·62%	284 10·38%	. .	303	270 89·11%	33 10·89%	. .
Texas	No	gradings											

PRODUCTION, PAYMENTS AND GRADINGS OF BUTTER IN QUEENSLAND, 1949–50—*continued.*

Factory.	Total.		Manufacture and Payments in Lb.				Over-run.		Make Graded.
			Choice	First	Second.	Pastry.	Actual.	Paid.	Per Cent.
Wide Bay Association, Gympie	Make	7,286,913	6,680,936	403,032	202,945	..	193,246	191,174	..
	Pay	7,284,841	6,800,465	320.333	164,043	..	2·72%	2·69%	95·23
Wide Bay Association, Cooroy	Make	1,427,514	1,122,426	283,640	21,448	..	36,754	36,520	..
	Pay	1,427,280	1,260,642	162,691	3,947	..	2·64%	2·63%	96·11

OFFICIAL GRADINGS IN BOXES—*continued.*

Factory.	Boxes Submitted As Choice	Result of Official Grading.				Boxes Submitted As First.	Result of Official Grading.			Boxes Submitted As Second	Result of Official Grading.		Boxes Submitted As Pastry.
		Choice.	First.	Second.	Pastry.		First.	Second.	Pastry.		Second.	Pastry.	
Wide Bay Association, Gympie	113,072	108,678 96·11%	4,394 3·89%	..	..	7,207	5,339 74·08%	1,868 25·92%	..	3,520	3,381 96·05%	139 3·95%	..
Wide Bay Association, Cooroy	19,033	14,166 74·43%	4,690 24·64%	111 0·58%	66 0·35%	5,046	4,355 86·31%	691 13·69%	.	354	354 100·0%	..	..
Totals ..	976,786	818,363	157,752	604	67	604,793	583,853	20,632	308	66,074	59,412	6,662	49

Queensland Cheese Production, 1949-1950.

PREPARED BY THE DIVISION OF DAIRYING.

THE production of cheese in Queensland for the year which ended on 30th June, 1950, showed a further drop, the quantity manufactured being 20,240,690 lb., compared with 21,033,063 lb. in the previous year.

This lower production is in keeping with the trend which has manifested itself since the cessation of the big wartime diversion of milk to cheese production and can probably be attributed to the less exacting requirements of cream production on the one hand and the increasing needs of the market milk trade on the other.

The graph in Plate 224 shows the movement in production over the past ten years.

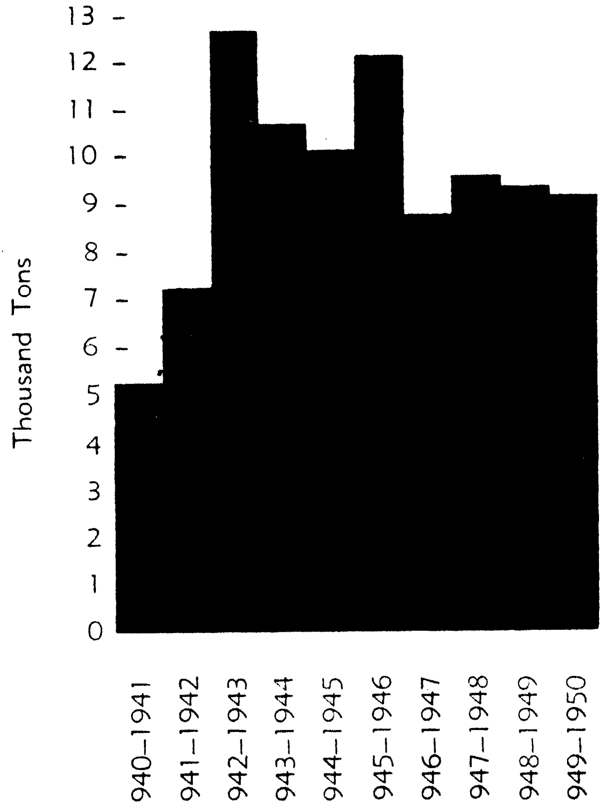


Plate 224.

Diagram Showing Cheese Production for Ten Years.

Gradings.

A total of 10,866,078 lb. cheese was graded during the year, representing about 54 per cent. of the quantity manufactured. This was a considerably smaller proportion than was graded in the previous year, but it is sufficient to give a useful indication of the trend in quality.

The most significant feature of the grading figures is the marked improvement in quality, the proportion graded as choice and first quality having moved up to the record level of 79.89 per cent.

The grading figures for the past five years are shown hereunder for purposes of comparison :—

Year.	Choice and First.	Second.	Third.
	Per Cent.	Per Cent.	Per Cent.
1945–46	70·27	25·28	1·45
1946–47	72·19	25·88	1·93
1947–48	63·00	34·40	2·44
1948–49	71·47	27·61	0·92
1949–50	79·89	19·45	0·66

In addition to the quantity of cheese referred to above, approximately 40,000 lb. of cheese which was submitted for grading was either prohibited from export, or in the case of cheese for local consumption, allotted no points because of its low standard of quality. The bulk of the prohibitions from export were due to cracked rinds or damage to the cheese during transit from the factory, but nearly 5,000 lb. of cheese, some of which was submitted for export and some for local consumption, was below standard.

A summary of the output and gradings is given below, and is followed by figures for individual factories. In noting grading figures, however, readers are asked to observe the proportion of the factory's output which was graded, as it may be too small to be representative.

SUMMARY OF PRODUCTION.

Milk Used	198,964,282 lb.	Yield of Cheese per 100 lb. Milk ..	10·19
Cheese Made	20,272,558 lb.	Yield per Pound Butterfat ..	2·67
Butterfat Paid For ..	7,575,746 lb.	Average Butterfat Test of Milk ..	3·81

SUMMARY OF GRADINGS.

Total Graded.	Choice.	First.	Second.	Third.
Lb.	Lb.	Lb.	Lb.	Lb.
40,866,078	64,300	8,616,569	2,113,734	71,475
	(0·59%)	(79·3%)	(19·45%)	(0·66%)

MANUFACTURE AND GRADINGS OF QUEENSLAND CHEESE FACTORIES

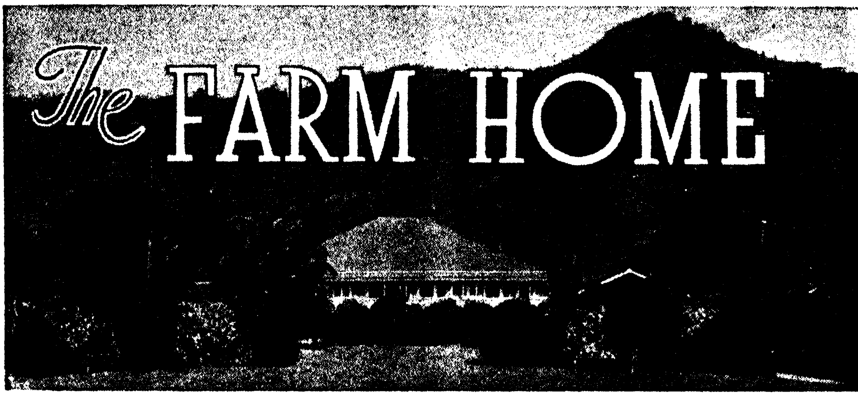
For the Year Ended 30th June, 1950.

Factory.	Milk Received.	Production and Yield.					Official Gradings.				
		Cheese Green Weight.	Butterfat.	Cheese Yield.		Average Test.	Total Lb. Submitted and Per Cent. of Manufacture	Choice.	First.	Second.	Third.
				Per 100 Lb. Milk.	Per Lb. Butterfat.						
	Lb.	Lb.	Lb.	Lb.	Lb.	Per Cent.					
Biddeston	6,447,159	688,620	245,952	10·68	2·8	3·81	357,854 51·97%	..	325,849 91·06%	32,005 8·94%	..
Coalstoun Lakes	1,999,523	207,426	75,826	10·37	2·74	3·79	32,978 15·9%	..	..	32,184 97·59%	794 2·41%
Dare Bros. Pty., Daredale	1,870,554	192,980	72,969	10·32	2·64	3·9	175,439 90·91%	..	105,575 60·18%	68,899 39·27%	962 0·55%
Dare Bros. Pty., Woodleigh	1,638,622	158,218	62,795	9·66	2·52	3·83	130,414 82·43%	..	87,072 66·77%	43,342 33·23%	..
Downs Association, Boodua	2,798,345	282,843	114,349	10·11	2·47	4·09	225,972 79·89%	..	216,300 95·72%	9,514 4·21%	158 0·07%
Downs Association, Toowoomba	25,486,920	2,587,781	978,250	10·15	2·65	3·84	2,287,906 100·0%	..	1,865,269 81·53%	420,090 18·36%	2,547 0·11%
Dundarrah	1,299,627	127,234	48,876	9·79	2·60	3·76	16,206 12·74%	..	..	13,197 81·43%	3,009 18·57%
Felton	4,429,156	467,044	170,935	10·54	2·73	3·86	315,330 67·52%	..	188,118 59·66%	127,212 40·34%	..
Greenmount	2,872,769	299,202	108,435	10·42	2·76	3·77	48,390 16·17%	..	3,900 8·06%	43,140 89·15%	1,350 2·79%
Highgrove	196,350	20,491	7,237	10·44	2·83	3·69	26,391 100·0%	..	5,280 20·01%	17,264 65·42%	3,847 14·57%
Irongate	3,516,097	347,822	129,295	9·89	2·69	3·68	245,207 70·5%	8,051 3·28%	219,766 89·62%	17,390 7·09%	..
Kooroongarra	4,103,408	408,774	148,007	9·96	2·76	3·61	460,953 100·0%	..	322,681 70·0%	138,272 30·0%	..
Kraft Walker Cheese Co. Pty. Ltd., Quinalow	8,854,484	925,106	329,702	10·45	2·81	3·72	208,718 22·56%	..	192,603 92·28%	14,180 6·79%	1,935 0·93%

Malling	6,091,788	585,486	238,232	9·61	2·51	3·83	30,785 5·26%	.. ..	482 1·57%	30,303 98·43%	.. ..
Maclagan Association, Maclagan..	8,113,152	808,334	300,807	9·96	2·69	3·71	270,259 33·43%	.. ..	69,301 25·64%	178,554 66·07%	22,404 8·29%
Maclagan Association, Kulpi ..	7,934,670	792,973	293,515	9·99	2·7	3·7	484,399 61·09%	.. ..	367,600 75·89%	116,639 24·08%	160 0·03%
Maryborough Association, Tansey	5,882,441	600,123	248,435	10·2	2·42	4·22	118,626 19·77%	35,163 29·64%	83,463 70·36%	.. ..	.. ..
Maxam Cheese Products, Cooranga North	7,948,416	849,257	330,094	10·68	2·57	4·15	715,596 84·26%	.. ..	532,247 74·38%	177,503 24·8%	5,846 0·82%
Maxam Cheese Products, Lilyvale	2,535,864	271,477	101,518	10·71	2·67	4·0	251,373 92·59%	.. ..	250,404 99·6%	969 0·4%	.. ..
Moola	4,479,206	447,602	164,954	9·99	2·71	3·68	240,768 53·79%	.. ..	196,891 81·78%	43,877 18·22%	.. ..
Mount Sibley	2,741,039	291,092	105,772	10·62	2·75	3·86	240,526 82·63%	.	240,526 100·0%	.. ..	.. ..
Mount Tyson	6,471,957	669,169	243,753	10·34	2·75	3·77	58,986 8·81%	. .	44,855 76·04%	14,131 23·96%	.. ..
Pittsworth Association, Pittsworth	8,512,538	898,749	340,163	10·56	2·64	4·0	283,694 31·57%	.. .	235,941 83·17%	47,753 16·83%	.. ..
Pittsworth Association, Linthorpe	2,174,297	231,087	83,604	10·63	2·76	3·85	130,708 56·56%	.. .	109,962 84·13%	19,995 15·3%	751 .57%
Pittsworth Association, Scrubby Mount	Closed	Down.					9,782 ..	.. ..	8,142 83·23%	1,640 16·77%	.. ..
Pittsworth Association, Springside	211,918	23,612	8,328	11·14	2·84	3·93	28,329 100·0%	.. .	28,329 100·0%	.. .	.. ..
Pittsworth Association, Yarranlea	4,979,968	493,762	187,752	9·91	2·63	3·77	254,785 51·6%	.. .	185,592 72·84%	68,623 26·93%	570 .22%
Port Curtis Association, Bracewell	4,729,135	480,494	175,773	10·16	2·73	3·72	278,474 57·96%	.. .	269,914 96·67%	9,280 3·33%	.. ..
Port Curtis Association, Theodore	2,835,911	293,373	108,872	10·34	2·69	3·84	73,565 25·08%	.. .	67,788 92·15%	5,777 7·85%	.. ..
Q.A.H.S. and College, Lawes ..	36,300	3,724	1,465	10·26	2·54	4·04	No	gradings			
Queensland Farmers', Booval ..	317,800	31,868	.	10·03	.	.	Nil	Nil	Nil	Nil	Nil

MANUFACTURE AND GRADINGS OF QUEENSLAND CHEESE FACTORIES FOR THE YEAR ENDED 30TH JUNE, 1950—*continued.*

Factory.	Milk Received.	Production and Yield.					Official Gradings.				
		Cheese Green Weight.	Butterfat.	Cheese Yield.		Average Test.	Total Lb. Submitted and Per Cent. of Manufacture	Choice.	First.	Second.	Third.
				Per 100 Lb. Milk.	Per Lb. Butterfat.						
Ramsay	1,779,037	179,530	67,874	10 09	2 65	3·82	157,350 87·65%	.. ..	69,900 44·42%	87,450 55·58%	.. ..
Rockview	2,337,302	242,840	91,108	10·39	2·67	3·9	158,214 65·15%	.. ..	153,435 76 25%	4,779 23·75%	.. ..
Rocky Creek	3,555,320	361,499	131,084	10·17	2·76	3·69	342,182 94·66%	.. ..	171,611 50·15%	155,553 45 46%	15,018 4·39%
Southbrook	6.516,410	668.109	240,660	10·25	2·78	3 69	379,197 56·76%	.. ..	334,562 88·23%	43,863 11 57%	772 0 2%
South Burnett Association, Goomeri	5,035,544	502.562	200,945	9·98	2·5	3·99	349,026 69·45%	11,680 3·35%	329,662 94·45%	7,684 2·2%	.. ..
South Burnett Association, Murgon	4,901,152	461,487	189,616	9·42	2 43	3 87	191,487 41·49%	1,276 0 67%	190,201 99,33%	.. ..	.. ..
Sugarloaf	1,953,405	197,129	80,188	10·09	2·46	4·11	108,593 55·09%	.. ..	86,202 79·38%	22,391 20·62%	.. ..
Sunnyvale	2,193,743	233,174	89,086	10·63	2·62	4·06	60,161 25·8%	. ..	48,715 80·97%	11,138 18·51%	308 0·51%
Warwick Association, Greymare	2,109,247	211,178	74,490	10·01	2·83	3·53	83,769 39·67%	.. ..	45,972 54·88%	31.899 38·08%	5,898 7·04%
Warwick Association, Talgai ..	1,029,834	103,329	39,672	10 03	2·6	3·85	22,097 21·39%	.. ..	.. ..	19,735 89·31%	2,362 10·69%
Warwick Association, Victoria Hill	690,980	71,037	24,988	10·28	2·84	3·62	5,707 8·03%	.. ..	. .	2,923 51·22%	2,784 48·78%
Warwick Association, Mill Hill ..	20,181,816	2,023,254	732,415	10 03	2·76	3·63	809,878 40 03%	8,120 1 0%	779,883 96·3%	21,875 2·7%	.. ..
Yamsion	1,754,788	179,575	64,046	10 23	2 80	3 65	71,653 39 9%	.	58,942 82·26%	12,711 17·74%	.. ..
Yargullen	3,416,350	352,182	128,909	10·31	2 73	3 77	124,351 35·31%	.	124,351 100·0%	.. ..	.. ..
Totals	198,964,282	20,272,558	7,575,746	.	.	.	10,866,078 54·0%	64,300 0·59%	8,616,569 79·3%	2,113,734 19·45%	71,475 0·66%



Diarrhoea in Infancy.

DIARRHOEA is an indication that the bowel is being irritated by some agent or other. The immediate results are that the intestinal contents are hurried along and excreted too rapidly, not allowing sufficient time for digestion and absorption of food and fluids to take place.

The bowel irritation may be caused by gastro-intestinal infection which is usually of serious import if not treated promptly and efficiently, or by improper feeding, especially overfeeding, which causes a digestive upset. Spoiled foods, foods which are not readily digested, or an infection elsewhere in the body, might decrease the infant's ability to digest the amount of food eaten and lead to increased bacterial action, an overstimulated intestine and hence, diarrhoea.

Before we discuss the abnormal bowel further let us say a few words about the normal. The stools which baby passes in the first few days of life are dark green in colour, but by the fifth day they will usually have assumed the characteristics they will show during infancy.

Usually a breast fed baby has from two to four bowel movements every day; the stools are yellow in colour and of soft, smooth texture. Occasionally they are less frequent, especially if the infant is underfed. Fewer motions—only one or two a day—are characteristic of the bottle-fed child. They are usually firmer and lighter in colour than those of the breast fed baby.

The colour of the motions is not important except as an indication of how rapidly food passes through the baby's body. The slower the digestive processes, the lighter the motions. If the baby develops diarrhoea, his motions may be dark green and foamy, because they have passed through his body rapidly. If he is constipated they may become much lighter in colour. A small amount of curds in the stool may be normal—the curds are merely ''soaps'' which have been derived from fats in the baby's food.

There is another variety of stool which may be described as lumpy or cheesy, where you can see white particles, varying in size, more or less oval or rounded in shape, scattered all through the motion. These round or oval particles are in some cases the remains of undigested milk and indicate that the child is getting more milk than he can digest. In other cases they consist simply of little balls of mucus, showing a catarrh of the bowel. Then there is a kind of stool in children which is extremely irritating, and which scalds the skin over the buttock and napkin area. These motions are usually caused by too much fat in the diet. Excess of sugar in the diet produces frothy acid motions of natural colour which also may cause scalding and irritation. Then there is a stool which may be described as ''slimy''; that means a stool which contains mucus in excessive quantity and indicates that some factor is causing irritation of the bowel.

Signs of Diarrhoea.

The symptoms of acute infantile diarrhoea or gastro-enteritis may begin either gradually or with great suddenness. It may come like a bolt from the blue, affecting a child which was, or appeared to be, in perfect health. The motions are noticed to be more frequent and often there is more or less vomiting. At first the stools are natural in colour—that is to say, more or less yellow—but before the diarrhoea has lasted long they become greenish, and finally they may come to contain mucus, or even blood. If the diarrhoea still persists, the motions become extremely offensive and of a watery consistence.

Treatment.

What should you do in the event of your baby getting diarrhoea? In any case of established diarrhoea a doctor's advice should be sought whenever possible; if you suspect that the feeding is at fault your Clinic Sister may be able to help you.

You should not attempt to treat the diarrhoea yourself but you can adopt temporary precautionary methods. When the bowel is in a state of irritation its main requirement is rest and time to overcome the source of irritation. Therefore, all foods, including milk, should be stopped for 24 or even 48 hours if necessary and nothing but boiled water, barley water or glucose water given. One of the main dangers of diarrhoea is the rapid loss of fluid from the body and this must be replenished at frequent intervals. If the diarrhoea is mild and clears up rapidly baby can then be gradually graded back on to his normal diet, commencing with well diluted milk mixtures—for example a mixture containing half milk and half water.

If improper feeding is the cause of the diarrhoea this should be corrected.

It should be remembered that gastro-enteritis is exceptionally rare in breast fed babies, for breast milk is the perfect natural food for infants and the danger of infection is practically non-existent provided that the mother is scrupulously clean in her personal hygiene.

Many babies are unnecessarily taken off the breast on account of diarrhoea and in almost all cases this is a very great mistake for breast milk is practically never at fault. Diarrhoea is quite often due to the mother taking certain purgatives which affect the breast milk, e.g., senna, aloes, cascara or rhubarb; so you should be aware of this and guard against it.

Prevention.

Prevention is always better than cure so take special note of these preventive measures:

1. Breast feed your baby for the full nine months if at all possible.
2. Always be scrupulously clean in your personal habits especiall before and after handling or feeding baby.
3. If baby is artificially fed, see that his milk and other foods ar kept in a cool airy place and well protected against dust and flies.
4. Always boil baby's milk and water before use.
5. Baby's feeding utensils should be kept scrupulously clean.
6. Always feed baby yourself. Don't allow baby to feed himself fron a propped bottle in his cot.
7. All used napkins should be transferred immediately to a covere bucket. Soiled napkins should be boiled before washing.
8. Don't allow dangerous dummies in the house.
9. If in doubt consult your doctor or Clinic Sister.

Any further information on this and other matters connected with chil may be obtained by communicating personally with the Maternal and C Welfare Information Bureau 184 St. Paul's Terrace, Brisbane, or by addres letters "Baby Clinic," Brisbane.

ASTRONOMICAL DATA FOR QUEENSLAND.

JANUARY.

Supplied by W. J. NEWELL, Hon. Secretary of The Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	4·56	6·46	Cairns	48	9	Longreach ..	43	27
6	5·00	6·47	Charleville	29	25	Quilpie	33	37
11	5·04	6·47	Cloncurry	63	36	Rockhampton ..	18	2
16	5·08	6·47	Cunnamulla ..	28	31	Roma	19	15
21	5·12	6·46	Dirranbandi ..	16	22	Townsville ..	40	9
26	5·16	6·45	Emerald	27	12	Winton	51	30
31	5·20	6·43	Hughenden ..	48	22	Warwick	2	6

TIMES OF MOONRISE AND MOONSET.

At Brisbane.

Day.	Rise.	Set.
	p.m.	a.m.
1	11·42	11·45
		p.m.
2	..	12·46
	a.m.	
3	12·17	1·51
4	12·57	3·00
5	1·43	4·12
6	2·38	5·23
7	3·42	6·28
8	4·52	7·26
9	6·04	8·14
10	7·18	8·54
11	8·19	9·29
12	9·20	10·00
13	10·17	10·30
14	11·13	10·59
	p.m.	
15	12·08	11·29
16	1·03	..
		a.m.
17	1·58	12·01
18	2·54	12·37
19	3·50	1·17
20	4·44	2·02
21	5·35	2.53
22	6·21	3·49
23	7·02	4·47
24	7·39	5·46
25	8·13	6·45
26	8·44	7·43
27	9·14	8·41
28	9·45	9·39
29	10·17	10·39
30	10·53	11·42
		p.m.
31	11·36	12·47

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	22	17	38	33	13	8	44	37
6	30	9	46	23	21	0	54	26
11	24	15	40	31	15	7	46	35
16	16	27	31	42	7	18	36	50
21	9	30	25	45	0	21	26	54
26	16	23	32	39	8	14	36	33
31	28	12	44	27	19	2	52	30

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	36	24	55	46	40	32	30	21
3	42	13	58	39	43	24	35	13
5	52	4	66	33	50	19	43	5
7	56	2	68	32	52	17	46	3
9	52	9	66	36	50	22	43	9
11	41	21	57	44	42	29	34	18
13	29	33	50	54	35	38	25	29
15	19	42	42	59	27	44	17	36
17	9	47	37	62	21	47	8	39
19	2	53	33	66	17	51	3	44
21	2	56	33	67	17	53	3	46
23	8	52	36	65	21	50	8	44
25	18	42	42	59	27	45	16	36
27	28	32	50	53	34	38	24	28
29	40	21	57	44	42	29	33	18
31	51	9	65	36	49	22	42	9

Phases of the Moon.—Last Quarter, 1st January, 3.11 p.m.; New Moon, 8th January, 6.10 a.m.; First Quarter, 15th January, 10.23 a.m.; Full Moon, 23rd January, 2.47 p.m.; Last Quarter, 31st January, 1.13 a.m.

On 15th January the Sun will rise and set about 24 degrees south of true east and true west respectively and on the 13th and 28th the Moon will rise and set approximately at true east and true west respectively.

On 2nd January the Earth will reach that part of its orbit at which it is nearest the Sun—91,400,000 miles will then separate the Sun and Earth.

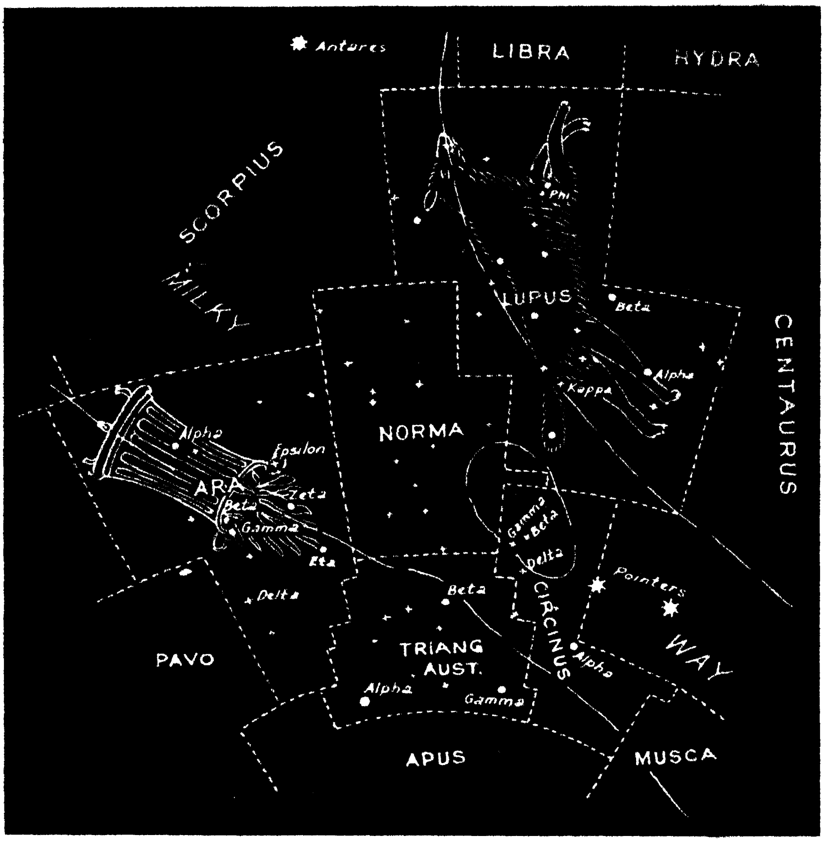
Mercury.—A morning object all this month, on the 1st, in the constellation of Sagittarius, will rise about sunrise, reaching greatest angle west of the Sun on the 23rd, when it will rise about 1 hour 50 minutes before sunrise. By the end of the month still in the constellation of Sagittarius, it will rise about 1¾ hours before the Sun.

Venus.—May now be seen low in the west during evening twilight. At the beginning of the month, in the constellation of Sagittarius, it will set about ¾ hour after sunset, and at the end of the month, in the constellation of Aquarius, will set about 1 hour after the Sun.

Mars.—At the beginning of the month, in the constellation of Capricornus, will set between 8.50 p.m. and 10.15 p.m., and at the end of the month, in the constellation of Aquarius, will set between 8 p.m. and 9.15 p.m.

Jupiter.—In the constellation of Aquarius, will set between 10 p.m. and 11.15 p.m. at the beginning of January, and by the end of the month will set between 8.15 p.m. and 9 p.m.

Saturn.—Rises between 10.15 p.m. and 11.30 p.m. at the beginning of the month and between 9.15 p.m. and 10.30 p.m. at the end of the month.



THE CONSTELLATIONS.

In the South Pole regions, between Scorpio or Scorpius and Centaurus and adjoining the constellation of Apus, are the constellations shown in the sketch. Triangulum Australis is very true to its name—a distinct triangle which follows the pointers round the pole. Alpha is reddish in colour, and close to Gamma is the red star 3 Trianguli. This star varies in magnitude, sometimes being visible to the naked eye and sometimes requiring the use of field glasses.

Circinus (The Compasses) is a small modern constellation which lies between Alpha Centaurus and Triangulum Australis. Alpha Circini is a double star which lies due south of Alpha Centauri. It is a yellowish star with a bright brick red companion of 8.8 magnitude. A line from Alpha Centauri through Alpha Circini brings the eye to an object which with binoculars looks like a faint comet with a tail. It is actually Gould's 6th magnitude star 22 Circini, with a "tail" of faint stars arranged in a line and in apparent contact. This constellation lies right in the Milky Way and is an excellent ground for doubles and clusters, &c.

Norma (The Square and Level) is a small constellation without any bright stars. It separates Lupus from Ara.

Ara (The Altar), another small, modern constellation, is situated close to the southern end of Scorpius. Beta and Gamma make a wide pair visible to the naked eye. A line from Zeta through Beta brings the eye to an object which in opera glasses appears like a luminous ball, a miniature of Omega Centauri; it is the cluster 70 Ara.

Lupus (The Wolf) adjoins Scorpio, Libra, and Centaurus and represents the wild beast made as an offering to the gods by the Centaur. It is a bright constellation but is rather overshadowed by the brilliance of its neighbour, Centaurus. Lying just on the edge of the Milky Way this area is also excellent for sweeping with a telescope.